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BRIEFLY TOLD.

THE SITUATION AT MONTREAL, CANADA.—A week ago we had occasion to refer to the uneven conditions obtaining in the gas supply of Montreal, which variable state is directly traceable to the competition for business that exists between the old Montreal Company and the Consumers Company; nor can it be said that the proprietors of either concern had been particularly careful in their pursuit of methods for securing customers. Of course, this lack of adhering to what might be called regular ways of increasing their trade is not to be wondered at, for at the bottom of the whole contest lies much of prejudice that exists in the public mind against the old Company, which fair-minded critics will likely attribute to the domineering and parsimonious policy followed by its proprietors in the days of the management of the Joseph's faction. The bald and unpleasant truth is that Mr. Joseph, who presided over the Company's fortunes for many years, did not live up to the times, forgetting seemingly that the monopoly which the city (for periods of 10 years) granted it, also carried certain obligations on its part toward the public. The gas rate at Montreal was not put at a reasonable figure until 1891, and up to 1892 the quality of the article supplied was not much to brag over, and when to high prices and indifferent quality one has to add the accusation of arbitrary treatment, it is not to be wondered at that the people were ready to give an eager hearing to speculators who promised them cheaper and better gas and fair treatment; so when Messrs. Coates & Co. appealed to the local authorities and to Parliament for a franchise and the right to operate in Montreal, it was not long before both sources of power assented, and the speculators had something tangible to work upon. Nor do we wish it to be understood that Messrs. Coates & Co. are regarded by us as other than mere speculators, nor that we consider them in any other light; they saw an opportunity to secure a valuable franchise, which opportunity was afforded them simply through the incapacity of the original possessors of the Montreal gas field to appreciate the possible outcome of their indifference to the reasonable needs of the citizens. The franchise obtained, the owners thereof were not put to any stress to secure capital for the purpose they had in view, and when the old Company awoke to the situation it was too late to save themselves, except by the outlay of a good sum in money—and even then President Joseph hesitated too long. The Coates Compay, which had in turn become (through ordinary barter) the Consumers Company, went ahead with construction work—of course, selecting the best territory of the city in which to commence operations—and had no trouble in securing consumers wherever its lines were available. Meanwhile, the opposition within the old Montreal Company to Mr. Joseph's domination therein became so strong that at the last annual meeting he "resigned" the Presidency in the midst of the muddle, leaving to his successor (Mr. Herbert S. Holt) the by no means easy or pleasing task of gathering the threads together. Mr. Holt, nothing daunted, accepted the position and its burdens, and, as the sequel shows, seems to have just now a trifle the better of his opponents. In their haste to become distributers of gas the Consumers' management overlooked a very important obstacle in the shape of an agreement between the authorities of Montreal and the Montreal Gas Company, under which the latter was virtually guaranteed the exclusive right to use the

streets of Montreal for purposes of gas supply, until May 1, 1895, although the agreement further provided that the authorities could, at the end of the eighth year of its life (April 30, 1893), permit another Company to apply for a franchise, and, in case such franchise were granted, such Company could construct works so as to be ready to supply gas on May 1, 1895. A week ago we reported that, as the result of proceedings for an injunction applied for by the Montreal Company to restrain its competitor from selling gas until May 1, 1895, the Consumers Company was so enjoined, and our current item columns contain a lengthy digest of the reasons which moved the trial judge (the Hon. Mr. De Lorimier) to grant the prayer of the plaintiff. The findings of the Court are specially important to the gas makers of Canada as a whole, in that he affirms emphatically the right of Canadian local authorities to grant exclusive franchises, his opinion in respect thereto being substantially as follows: "The city has the control of the streets and may say what use shall be made of them for the greater benefit of citizens. The Council had a perfect right, therefore, to grant an exclusive and temporary right to the plaintiffs. This is not an illegal monopoly." It is true that the judge uses the words "an exclusive and *temporary* right," but this implied qualification is not heavy when one remembers that 50 or more years would not constitute a period of perpetuity. Of course much confusion has resulted from this decision, particularly since a judge in chambers under the Quebec law had no power to interfere with the operation of the injunction, wherefore an appeal could not be taken until the meeting of the full bench, which does not convene until September 15. The Montreal Company, we understand, has refused to accept other than the pound of flesh to which it is entitled, declining to supply gas to the customers of the Consumers Company through the meters of the latter; nor would it agree to supply gas to the Consumers Company, the latter to pay for the consumption registered on the meters of the consumers. Thus the matter stood according to our last available advices, which bear date of August 28th.

RUMORS ABOUT THE BROOKLYN SITUATION.—We understand that an agreement has been reached whereby the Addicks interest in several Brooklyn (N. Y.) Companies—the Brooklyn, Metropolitan and Citizens—is to be taken over by the Fulton-Municipal management, who are also virtually in control of the Peoples Company. The Fulton-Municipal interest in the Brookline (Mass.) Company is to work in harmony with the Bay State interest in Boston, and if this be so the Brooklyn lion and the Boston lamb are at peace, so far as each other is concerned. In this light the five named Brooklyn Companies—the Fulton-Municipal, the Brooklyn, the Citizens, the Peoples and the Metropolitan—are at present opposed to Williamsburgh and the Nassau Companies; and a very pretty contest they could make of it. However, it looks that the end of a very ridiculous gas war draws nigh.

AN AMERICAN-IRISH GAS MAN.—From our foreign exchanges we note that the annual meeting of the North of Ireland Association of Gas Managers, which was brought off in mid-August, at Armagh, Ireland, was a very successful convention in every respect. Apart from its success, however, we note that the President-elect is Mr. P. J. Salmon (of the Galway gas works), who some years ago was connected with the engineering department of the Central Gas Company, of this city, and who will be remembered by those who were acquainted with him as a painstaking, competent man. In further mention of the Armagh meeting we reprint the following remarks from the address of the gentleman (Mr. C. B. Outon) who preceeded Mr. Salmon in the Presidential chair:

"I am pleased to note that demonstrations of cookery by properly qualified lecturers have been given in many towns, thus tending to considerably enhance the revenues of gas companies by the extended adoption of gas cooking stoves. But is it necessary for lectures to stop at applications to cookery? I take it one of the chief objects is to create an increased day and summer consumption, and thus procure a maximum of return for the outlay of capital. There is no reason why the attention of the public should not be occasionally called in this way to the many advantages to be derived from the further application of coal gas to gas fires, for intermittent service and sick rooms, the heating of bath water, and heating burners for laundry work. With regard to gas fires, I fear they may have occasionally fallen into bad odor by the lighting back of the burner, and the consequent unpleasantness produced by the formation of acetylene. A very recent invention, which has entirely overcome this difficulty, will doubtless increase their popularity."

A CHARTER has been granted for the Suburban Gas Company to Thos. Dolan, S. T. Bodine, Randall Morgan, Ed. C. Lee and G. S. Philler, which is formed for the purpose of supplying gas to the suburban districts of Harrisburg, Pa.

On the Manufacture of Fireclay Gas Retorts, and the Advantages of Having Standard Sizes.

[A paper read by Mr. P. Hurll, of Glasgow, before the North of Ireland Gas Managers' Association.]

When your esteemed Secretary, Mr. Whimster, asked me to read a paper at your present meeting, I naturally selected the subject with which I am most conversant, and trust the few remarks I am about to make, in reference to the manufacture of fireclay gas retorts, and the advantages of having standard sizes, will be acceptable to the members of the Association.

My whole business life has been connected with the fireclay trade; and since 1857 till the present time I have been engaged in the manufacture of fireclay goods. In 1857, when I joined my father's business, iron retorts were still much used. At that period there were two gas companies in Glasgow—the Glasgow Gas Company and the City and Suburban Gas Company. The latter Company's works were at Dalmarnock, and the former Company had stations at Townhead, Tradeston and Partick. Mr. Ritchie, the Manager of the Glasgow Gas Company, used fireclay retorts at all three stations; but Mr. Bartholomew, the Manager of the City and Suburban Gas Company, used only iron retorts, and continued to do so until the works passed into the hands of the Glasgow Corporation, and under the management of Mr. Foulis, who very soon substituted fireclay retorts for the iron ones at the Dalmarnock station. Since that time fireclay retorts have driven iron ones from the field, and it is an exceptional thing to see iron retorts used for the manufacture of coal gas, except in small private gas works, where the retort is only occasionally heated up.

Some people are under the impression that fireclay is a soft material, such as the clay used in the manufacture of common or building bricks, but this is not so. It is a very hard mineral, and is worked from a pit or shaft the same as coal, at considerable depth, varying in my district from 120 to 300 feet. Fireclay is mined by boring, and blasting with gunpowder; and you have here a sample of fireclay as it comes from the mine. When exposed to the weather for a considerable time it disintegrates, and becomes much easier to mill.

Process of Manufacture.—The fireclay is ground in a pan-mill, under two cast iron rollers 4 feet 6 inches diameter by 12 feet broad on face, weighing each about 4 tons. This pan is fitted with perforated gratings—the fireclay when ground falls through the gratings into a pit, where a set of elevator buckets on an endless belt carry it up and throw it into a circular sieve about 3 feet diameter by 9 feet long. The fireclay which passes through this sieve falls into a hopper supplying the wet or tempering mills; and the rough pieces which will not pass through the riddle are returned to the mill for regrinding. This sifted fireclay is run by shoots into the wet or tempering mills, and there mixed with water and a certain proportion of crushed burned clay. It is ground to a proper consistency for the description of goods it is intended for, placed in a boggie, and run to where it is to be used. All fireclay retorts made in Scotland are built by hand; no machine-made retorts being manufactured. One of our largest gas works, some years ago, used a large number of machine-made retorts, but they did not give satisfaction and the experiment was not repeated.

When the prepared fireclay is delivered to the retort builder he first beats out the bottom of his retort the exact shape of the body, and he then places on it his retort drum, and begins to build. The clay is formed into small rolls by his boy, and he builds round the drum, and for the thickness of the body he uses his frame. I have here a drum and frame used in building the Glasgow Corporation gas works retorts. After the retort builder has built about 4 feet, he coats the inside and outside of the retort with very fine ground clay, mixed with water to form "slurry," and polishes with a steel tool. There are usually 80 to 150 retorts on the stove floor, and the builder goes over them in rotation, building a small quantity at a time. This continues from day to day until the retort is up the height were the mouthpiece is formed. He has another frame for the mouthpiece, showing the position of the bolt holes; and he either contracts or expands the mouth, as required to suit the template.

The retorts are allowed to dry, and are then transferred to the kiln or oven, where they are slowly fired for 48 to 60 hours—the heat being very gradually raised until the kiln is in full fire, when another period of firing at high heat is continued for 48 to 60 hours, until the retorts are sufficiently hard burned. This is ascertained by trials withdrawn from the kiln at different parts of the process. The tools required in building are principally a spirit-level and plumb-line, steel scrapers, knives and polishers.

Mixing Materials.—Makers are very conservative with regard to the

material used in building gas retorts; if the fireclay is found suitable for retorts, they do not care to experiment with it. They have no means of testing by actual results, and are afraid consumers may complain as to the variation of quality. I am of opinion that the users of retorts should make suggestions as to new materials or method of treatment; or if a manager would allow the makers to supply retorts for trial and experiment, it would encourage manufacturers to try variations in the mixture of fireclay with other materials, so as to produce retorts tougher and more elastic, and not liable to crack; also enamels or glazes to prevent carbon adhering to retorts.

For many years I made retorts for one of the largest companies in Scotland; and the mana ,er's instructions were to mix with the fireclay a certain proportion of a very fine and plastic yellow clay. He assured me that the retorts so made were tougher, had a longer life, and were not so short as those made from pure fireclay. I have also salt-glazed retorts all over, inside and out; and enameled them inside only, to prevent carbon adhering. But in actual working the enamel soon wears off, owing to friction in charging and drawing. I have lately made a number of retorts 4 inches thick in the body, and enameled inside, for making oil gas by the Peebles process; but they are not yet working, and I cannot say whether the result will be satisfactory or not. I fain hope it will be.

Standard Sizes.—I now pass on to the question of standard sizes. Before I left Scotland I asked my works manager to furnish me with a list of the various sizes of retorts made at my works. I find there are 44 sizes of ⏍ retorts, varying from 13 inches by 11 inches to 30 inches by 15 inches; 12 sizes of oval retorts, varying from 16 inches by 14 inches to 24 inches by 15 inches; 7 sizes of round retorts, from 12 inches to 18 inches diameter. For these 63 sizes of retorts I have 140 different mouthpieces, the bolt holes being all different, and the slots of three different sorts—T, screwing into nut, and bat bolts.

You will understand that there is some difficulty in keeping a correct record of the various mouthpieces, templates and descriptions of slots; and if there is any change in the retort builders it requires continual care to keep them right. There is also the question of the position of the bolt holes. No doubt you have often found that the holes do not come in exactly to suit your cast iron mouthpieces. In building retorts there must be an allowance of ⅛ inch per foot every way for shrinkage from the green to the burned state. Thus a retort 24 inches by 18 inches inside must be made 25½ inches by 19 inches, and in addition there is the shrinkage on a mouthpiece 5 inches thick. The builder may cut his bolt holes exactly to template; but there may be a difference in the nature of the fireclay he is using, or in the burning, and when the retorts come from the kiln the bolt holes do not fit the mouthpiece.

At the present time retort building is a season trade, extending for 7 months—say from February to August; and there is great pressure for deliveries, especially in June and July. I hold that if standard sizes were adopted the business could be carried on all the year round, and the retorts be stocked until such time as they would be required. A manager could then, in case of a breakdown, get a retort at any time without waiting until his own special size was made. The manufacturer also could go on making steadily all the year round, and give all retorts built his careful attention; whereas at present, in the busy part of the season, the work is pushed on as quickly as possible. No maker at present cares to make retorts for stock, as all sizes are special; and although he may hold the order for a gas works this season, there is no guarantee that he may have the same order next season. It would also be an advantage to the ironfounder, as mouthpieces would be the same all over, and these could be held in stock the same as retorts, and supplied as required. I do not say there should be only one size of retort for large and small works; but three or four sizes could be selected, and the lengths made in 3-inch sizes, beginning at 8 feet and running to 9 feet, or even 10 feet.

It would be a great advantage to gas works managers and retort makers if some of the gas managers' associations would take up this matter; and I do not see why your Association should not lead the way.

The Heating Power of Smoke.

Mr. R. R. Tatlock, in a communication to *Chemical News* on this subject, says:

It appears to be generally understood that a large percentage of fuel is lost in the smoke which issues so abundantly from most chimneys, and random statements have been made to the effect that the loss in heating power due to this passing away of combustible matters in smoky furnace gases may reach as high as 30 per cent. of the whole. A little consideration, however, will show that the loss of any large percentage of combustible matter, and consequently of heating power, is quite out of the question. This may be proved in two ways—(1) by calculation of the two sources of heating power as shown by an analysis of coal or dross used for steam raising; and (2) by actual analysis of the furnace gases for combustible solids and gases.

In the following paper are given the results of these two methods of observation, the same dross being analyzed and also employed as fuel in works furnace, from which smoky gases were given off which were tested for combustible matters.

1. The following is the analysis of the dross employed:

	Per Cent.
Gas, tar, etc	37.63
Fixed carbon	49.97
Sulphur	0.40
Ash	2.72
Water	9.28
	100.00
Heating power (practical) due to gas, tar, etc.	1.16
" " " " fixed carbon	6.49
	7.65

The points to be observed are the relative proportions of heating power (represented in the analysis by the number of pounds of water at 212° F. capable of being evaporated to dryness by 1 pound of the fuel) given out respectively by the combustion of gas, tar, etc., and by the fixed carbon. These are calculated according to Playfair's well known formula, which was practically tested on coals intended for the British Navy, and which shows that while 1 pound of fixed carbon is capable when burned of evaporating 13 pounds of water at 212° F. to dryness, 1 pound of the gas, tar, etc., will only evaporate 3.1 pounds. From these figures it appears that in the coal or dross the gas, tar, etc., only contribute 15 per cent. of the total heat given out during the combustion, and that the fixed carbon produces the remainder, or 85 per cent. In coals with less of the former ingredients and more of the latter, which is commonly the case, the proportion given out by the volatile constituents would be considerably reduced. It is thus perfectly clear that even though the whole of the volatile matters (which can alone be accountable for any loss of combustible material) escaped combustion, there could not possibly be a greater loss of heat than 15 per cent. of the whole, even in such an extreme case as this represents.

2. An analysis was made of the furnace gases given off during the burning of the dross, of which the results are given above, with the following results:

	Gases Very Smoky. Per Cent by Volume.	Gases Almost Free from Smoke. Per Cent. by Volume.
Carbonic acid	5.0	3.5
" oxide	none	none
Hydrocarbons	trace	none
Nitrogen	79.9	79.9
Oxygen	15.1	16.6
	100.0	100.0

It has been asserted that carbonic oxide is given off in considerable quantity when much smoke is being produced, but it does not appear in this case; and Hempel, in his work on "Gas Analysis," comes to the conclusion that little or no combustible gases are present in furnace gases. He says, "Furnace gases usually contain only carbon dioxide, oxygen and nitrogen. All other gases are present in but very small amounts. In oft-repeated analyses the author has always found only traces of carbon monoxide, methane and the heavy hydrocarbons." This is in complete accord with the analyses given above, and it may be taken for granted that the presence of carbonic oxide or other combustible gases in furnace gases is a most unusual occurrence. This is quite conclusive evidence that no appreciable loss of heat, even when the furnace gases are smoky, can be attributed to the passing away of the products of imperfect combustion in the gaseous form at least.

That there is loss of combustible matter in the smoke is an undoubted fact, but the quantity seems also to be greatly magnified in certain random statements. In the experiment referred to above, the soot was also collected during one hour and a half with the following results:

	Grains per 100 Cu. Ft. of Furnace Gases.
Carbonaceous matter	30.81
Ash or mineral matter	20.65
Total soot	51.46

It will be observed that the soot collected consisted largely of mineral or incombustible matter. In several experiments to estimate the soot in furnace gases, similar results to those were obtained, and the average would come very close to the quoted results of this special test.

To find how much carbonaceous matter was actually lost as smoke, it will be necessary to know the number of cubic feet of furnace gases given off by the combustion of, say, one ton of the dross. If the percentage of carbonic acid in the furnace gases is taken at 5 per cent., the total volume of these given off from one ton of dross would be about 940,000 cubic feet, measured at the ordinary temperature and pressure, and this would contain 41 pounds of carbonaceous matter and 27 pounds of mineral matter. This would represent 1.8 per cent. of the volatile matters (gas, tar, etc.) given in the analysis of the dross; and if from this is now calculated the heating power according to Playfair's formula, it will only come to 0.057. This figure, compared with the practical heating power (7.65) of the dross, goes to show that the solid combustible matter of the smoke can only account for the very small percentage of 0.74 of the total heating power which can be obtained from the coal.

From the results of these experiments it is evident that the loss of combustible matters in smoke is very small indeed, and that the belief in immense loss by this cause is simply a fallacy, and it is decidedly not corroborated by experiment. In adopting methods of removing the smoke nuisance, it must therefore be borne in mind that there is little or no gain in burning smoke, and that other methods of dealing with the problem, such as Dulier's smoke absorption process, ought also to receive consideration.

Brownhill's Automatic Gas Meter.

English Letters Patent (No. 12,184) were granted recently to Mr. R. W. Brownhill, of Aston, Birmingham, for an improvement in automatic gas meters. The following description of the apparatus is taken from the London *Journal:*

This invention relating to improvements in automatic sale and delivery coin-feed attachments for gas and liquid meters is an improvement upon, or an amplification of, four patents granted to the same patentee—No. 7,012 of 1887; No. 20,583 of 1889; No. 5,378 of 1891; and No. 13,181 of 1892. The present invention has for one of its objects "a new price changer, whereby rachet teeth in the changing mechanism are dispensed with; another of its objects is the differential speeding of the index finger and disc wheel; and another of its objects is "the simplicity of the construction of the general mechanism, with reduction of the cost of production."

Fig. 1 represents the front elevation (with the enclosing casing in section) of an automatic meter attachment made according to this invention. It shows the handle or turn of the principal axis; also the range arm and stop of the price changer, and the means for varying the position of the arm relative to the range stop, so as to determine the number of cubic feet of gas to be delivered to the payee. The view also shows the valve and the arm for operating it. Fig. 2 is a back elevation of the attachment, with parts in section. This view represents the coin shoot, the quantity wheel, the operating lever, and portions of the clutch mechanism. Fig. 3 represents a complete side elevation of the attachment, with nearly the whole of the component parts. Fig. 4 is a longitudinal vertical section of Fig. 1, showing the component parts of the attachment, and the transmitting gear. Fig. 5 is a cross section of the quantity wheel and its clutch; also the back stop, for limiting the retrograde movement of the clutch mechanism.

The main axis, supported by suitable framings, carries upon, and has made fast to it, a turning handle *D* at one end, and a hook-ended and double armed lever *E* at the other end, and a range arm *F* of the price changer near the handle end. There is an oscillating extension of the coin shoot *G*, open top and bottom; while the sides of its lower end are gapped sufficient to make a complete clearance for the passing through it of the hooked end of the lever *E*, turning with the end of the axis *A*, on the lever making a part rotation when no coin is in the coin shoot extension. The shoot extension carries a counterpoised excess lever *H*, jointed to a bracket carried by the walls of the extension, and with its upper and curved end normally lying without the path of the mouth of the shoot extension, but with the tail end normally lying within the throat of the extension. In this way, when a coin is dropped down the shoot, it gravitates into the lower part, and in running down it strikes against and presses outwardly the tail end, and at the same time turns inwardly the other end across the open mouth of the shoot extension. The coin then comes upon the rest ear or extension of the fixed bracket *I*, which lies partly within the path of the lower open end; and the excess lever is thus blocked in its mouth-closing position by the upper par of the coin resisting in front of the tail end. The lever *E*, which is fas upon the principal axis *A*, has a stop arm, which takes its abutment against the back wall of the shoot extension, and limits the backward movement of the principal axis and the lever and the parts carried by the axis.

The clutch mechanism, which makes the connection between the principal axis, the coin shoot extension, and the quantity or measuring out wheel *J*, consists of a link with the inner end joined to a stud on one of the sides of the shoot extension, and with its other end jointedly connected to a clutch lever *K*, pivoted to a rising and falling carrying bracket, mounted upon the main axis; while the bearing contact of its short arm or heel comes against the plain periphery of a disc wheel, which has made fast upon its axis (working within bearings of a fixed bracket carried by the rising and falling ar.i) a pinion, which intergears with the teeth of the quantity or measuring out wheel *J*, having a bushed or bearing sleeve made fast with it, and formed integral with a toothed sun wheel having 41 teeth, and forming the driving wheel of the epicyclic train. This wheel intergears with one pinion of a planet twin pinion *M*, whose axis is directed through a bush or hollow axis, made integral with the meter tangent wheel. This is loose upon the main axis *A*, and is driven by a worm rotated from the meter drum by the impelling sorce of gas passing through the meter.

The second pinion of the twin planet pinion *M*, each of which has 15 teeth, intergears with the teeth of a second toothed sun wheel having 40 teeth, and made fast to the hollow neck or sleeve carrying the disc wheel *N*, and having a notch with inclined sides (wherein a tooth or stud of a valve operating lever *S* engages), and with the forward necked extension having made fast to it a pointer, which traverses the face of the graduated dial *O*, which is marked off into a scale indicative of 300 or other number of cubic feet of gas, and is made fast to the general framing of the attachment. Located between the framing and the face of the quantity wheel *J* is a spring friction clutch *P*, for holding the whole of the gear wheels and components stationary while the meter wheel is being rotated by the impelling force of gas passing through the meter, and while the planet pinions are rolling round the toothed peripheries of the sun wheels, and effecting the necessary reduction in the speed of the disc wheel *N* and pointer.

The too free movement of the shoot extension is obviated (or it is made stiff in its movement) by the free end of a pressure spring or lip *Q*, pressing against the side of the framing of the attachment. The clutch mechanism is limited in its back movement by a stop carried by the general framing, while the clutch lever *K* is also limited in its backward movement by a stud carried by a rocking or rising and falling bracket.

Situated under the outlet of the coin shoot extension, and under the coin rest of the bracket *I*, is a trough *R*, down which coins slide into the coin box or receptacle placed within the interior of the casing of the meter. The back end of the valve operating lever *S* is connected to the valve by the joint located within the valve chest, and adapted to open and close the gas way of the service.

In the price changer, the range arm *F* has an adjustable stop, consisting of a screw which worms in and out of the screw box, made through the end of the arm for fine adjustment of the range. *T* is a rotating price indicating dial—having pence graduations and numerals upon it, and being mounted loosely upon the axis *A*, and integrally connected with a toothed pinion, which latter intergears with a like pinion *U*, made secure to a supplementary axis carrying fast upon it a pinion which intergears with the teeth of a toothed sector *V*, also mounted loosely upon the axis *A*, and being provided with a forward stop, whose position determines the motion of the range arm *F*, and thereby indicates, according to the range, the amount of gas to be apportioned out to the payee. Thus, supposing that gas is 2s. 11d. per 1,000 cubic feet, then the dial *T* is rotated until the numeral 35 comes opposite the termination of a mask or wing *W*, gapped so as to allow a portion of the price indicating dial *T* to be seen. In making an alteration in the price changing mechanism consequent upon a change in the price of gas, an official breaks the seal, and then (by a key) adjusts the position of the range stop relative to the back stop of the range arm; and after adjustment, he forces the clamping plate home, thereby preventing the dial *T* and the quadrant stop from being changed or tampered with by consumers.

Assuming the price changer is sealed in a position adapted to deliver gas in pennyworths at the rate of 2s. 11d. per 1,000 cubic feet, then to adjust the changer to apportion out pennyworths of gas at the rate of 3s. 4d. per 1,000 cubic feet, the official would proceed as follows: He would break the official seal and slacken the nut and clamping device, then insert a key and rotate the axis which turns the wheel *U* until the

numeral 40 upon the dial *T* comes linable with the indicator. At the same time, a pinion engages with the teeth of the toothed sector *V*, and turns it from left to right, and with it the range stop is so turned as to decrease the distance between the back position of the range stop arm *F* and the forward range stop. In this way less gas is apportioned out to the consumer consequent upon the rise in the price of gas. From this it will be seen that, by changing the position of the dial *T*, the motion of the range arm *F* is decreased or increased, and the quantity of gas apportioned out to the consumer is increased or decreased accordingly, and the winding-up mechanism is moved through a greater or less range on the turning of the handle on a penny or a succession of pennies being introduced.

Assuming that the whole of the parts are in their normal relative position (as shown), and assuming that a coin *Y* has been dropped down the coin shoot *G*, in its traverse it strikes against the tail end of the excess lever *H*, and presses the end out of its path. The coin then falls upon the rest of the fixed framing *I* (see dotted lines in Fig. 2), while the top part of it holds the excess lever back and keeps the other hooked end across the mouth of the coin shoot extension until the coin has been liberated. In this way excess coins are prevented from being introduced into the shoot until an equivalent in gas to the one previously tendered has been placed (so to speak) to the credit of the payee.

The introduced coin couples together the apportioning-out parts of the mechanism, and the continued motion of the handle turns the shoot extension forward, with a free movement upon its bearing centers, and at the same time turns the clutch lever *K* backwards upon its axis. When the shoot extension has assumed a nearly vertical position, the bearing face of the short arm of the lever is brought up to the plain periphery of the wheel, and by the frictional contact of the surfaces thus brought together the motion of the pinion is arrested, or the pinion is held fast, and so also is the quantity wheel *J* intergearing with it. The result is that, on the still continued rotation of the handle, the whole of the parts (less the meter wheel and its twin pinions) are bodily moved back together, until the motion is arrested and the parts blocked from further progress, by the end of the pin of the range arm *F* coming against the forward range stop of the toothed sector *V* of the price changer.

Motion is transmitted from the quantity wheel *J* to the notched disc *N* through a sun wheel, which drives the pinion and communicates motion to a pinion, which in turn communicates its motion to a second sun wheel at a considerably reduced speed, and through the sleeve of this pinion to the disc wheel *N* and finger. By this rotation of the disc, its notch is taken away, so as to turn the lever *S* outwardly upon its joint and take the valve from its seat in the valve chest, and so open the gas way in the service.

The handle is then turned in the reverse direction, when the whole of the mechanism for a time remains, and is kept quiescent by the friction clutch *P*, located between the quantity wheel *J* and the adjacent walls of the upright framing. As the motion is continued, the axis has a limited free movement, which takes the hooked end of the lever *E* (fast on the end of the axis) from under and without the range of the coin *Y*, and immediately the hooked end comes clear of the coin (as in Fig. 2), the coin falls on to the inclined trough *R*, and from thence slides into the coin box.

Directly the coin is released, the short arm of the lever *E* comes against the back of the oscillating coin shoot extension, which is then carried forward and with it the link and the clutch arm *K*, and the acting and gripping face of its short arm is moved, so as to release the clutch from its engagement with the quantity wheel; and as the clutch mechanism and the shoot extension and the parts carried by them are brought back to their normal position, the pinion rolls over the teeth of the periphery of the quantity wheel, until the arm carrying the clutch mechanism is stopped by coming against the forward range stop, so that the range of motion of the mechanism is between the fixed stop and the adjustable stop.

The meter drum now being impelled round by the pressure of gas passing through the service, communicates rotary motion to the worm axis, at the rate at which gas is being delivered and consumed, and rotary motion is transmitted from the axis to the meter wheel. As the first sun wheel (having 41 teeth) and the quantity wheel *J* remain quiescent, the pinion rolls around the toothed periphery of the wheel, and through it the twin pinion *M* is rotated and its pinion is made to roll upon the toothed circumference of the second sun wheel, having 40 teeth. This turns the disc wheel *N* around backwards to an extent equal to one tooth to every complete rotation of the meter wheel. The notch in the disc *N* has now been brought back to its normal position, and the tooth or stud has passed again into the notch. Then by the angular movement made by the valve operating lever *S*, gas is cut off by the closing of the valve, and the payee has had dealt out to him an equivalent in gas for the coin deposited.

On introducing a second coin into the coin slot, the same operations are repeated; and on the introduction consecutively of further coins, after each preceding coin up to 12 has been placed to the credit of the payee on the dial, the return movements of the mechanism are operated only as the consumption of gas is effected; and until the notch in the

Fig. 1

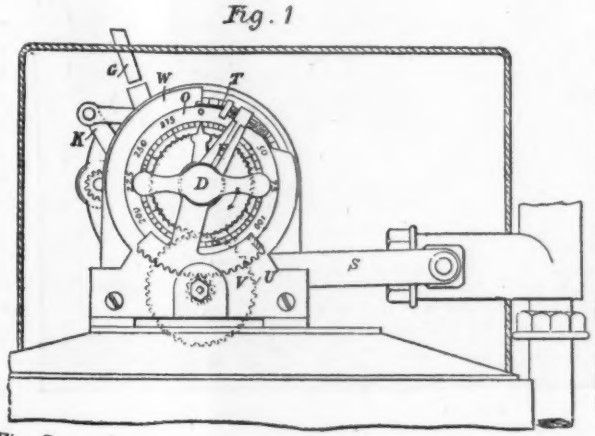


Fig 2

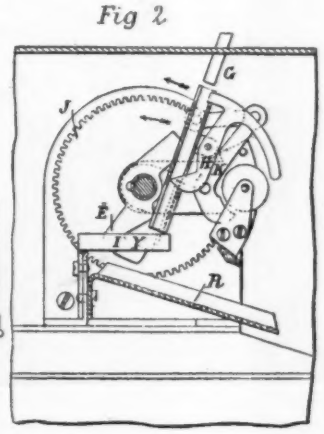


Fig 3.

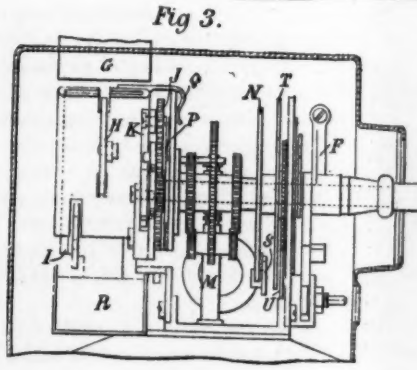


Fig 4.

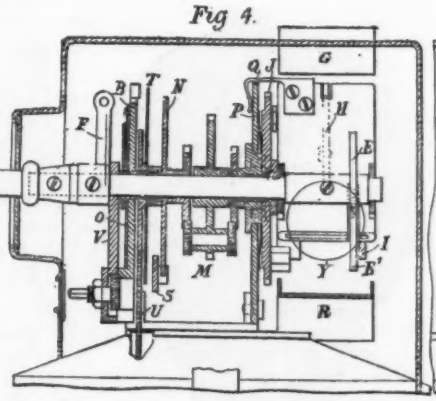
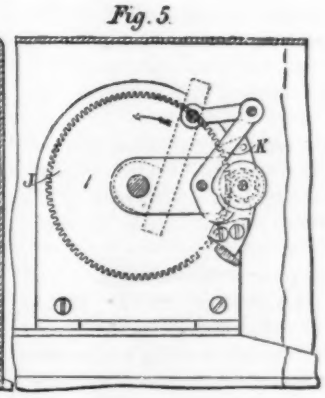


Fig. 5.



disc has been brought back to its valve-closing position, and coincident with the stud on the valve arm, so long will the attachment be at liberty to deliver the gas due to the payee as it may be required.

A New Recording Thermometer for Closed Spaces.

In designing this thermometer the object has been to produce an instrument which would make a continuous record, day and night, of the temperature in heaters, ovens, dry kilns and such closed spaces, and at the same time permit the recording portion of the apparatus to be located at any convenient point outside of the room or kiln, where the temperature is to be measured.

The instrument is shown in Fig. 1, set up and ready for operation. The wall of the oven is broken away, showing the coil of pipe, suspended at the point where it is desired to measure the temperature. The recording part of the instrument is shown at the left side of Fig. 1, and is connected to coil *D*, in kiln or oven, by a small flexible copper tube. Fig. 2 shows the interior of the recording portion of the apparatus which consists simply of one of Bristol's recording pressure gauges. The coil *D* in the oven is partly filled with alcohol, and the remaining air is exhausted. When heat is applied to the coil, the vapor of the alcohol condenses and completely fills the pressure gauge tube and the small copper tube leading to it. The pressure due to the temperature of the oven or kiln is transmitted to the recording gauge.

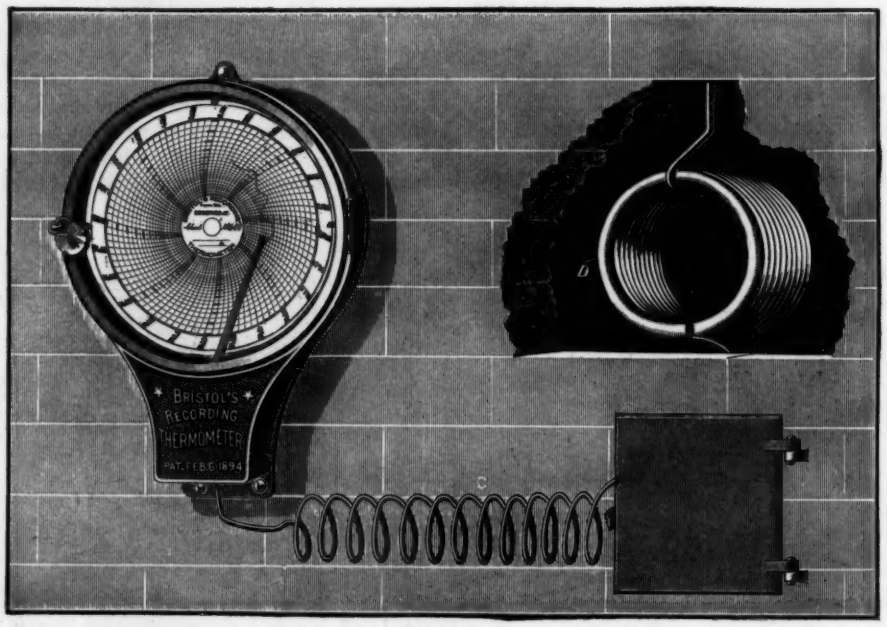


Fig. 1.

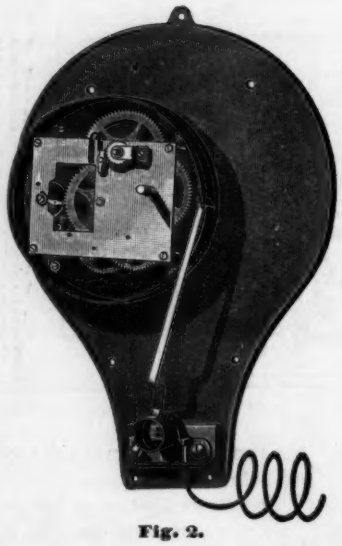


Fig. 2.

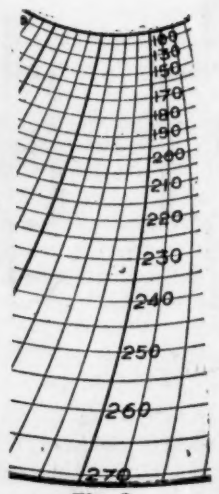


Fig. 3.

The scale on the gauge chart is graduated in degrees Fahrenheit by means of a standard thermometer. The coil *D* is immersed in oil for standardizing and graduating the chart.

There is no compensation required for changes of temperature in the room where the recorder is placed, as the small copper tube is completely filled with alcohol, and the pressures due given temperatures are always the same.

Fig. 3 shows a specimen section from chart of one of these thermometers for a range of 270° F. It will be observed that between 170° and 270° the scale is very open. A number of these instruments have been in successful operation in rubber works for the past four months for keeping a record of the temperature in heaters during the process of vulcanizing rubber goods.

These thermometers are being manufactured and placed on the market by the Bristol Company, of Waterbury, Conn.

A working model of this apparatus was exhibited and described at the Brooklyn Meeting of the American Association for the Advancement of Science by Prof. W. H. Bristol.

Action of Light on Dyes.

The Chemical Section of the British Association some time ago appointed a special committee to inquire into the action of light respecting dyed colors, and in reporting thereon the investigators, among other things, say :

During the year a large number of wool and silk patterns, dyed with various natural and artificial orange and yellow coloring matters, had been examined with respect to their power of resisting the fading action of light. The patterns were exposed at Adel, near Leeds, in the grounds of Mr. James A. Hirst. Each dyed pattern was divided into six pieces, one of which was protected from the action of light, while the others were exposed for different periods of time. On silk, the relative fastness of the various colors was, for the most part, the same as on wool, the differences being unimportant. Orange and yellow patterns give a comparatively large number of satisfactorily permanent colors. In the more or less fugitive class were to be found all the basic colors, all the nitro-phenols, with the exception of palatine orange, and all the bright yellows derived from the natural coloring matters by means of aluminum and tin mordants, with the exception of those obtained from weld. Comparatively few azo colors were met with in this group. By far the largest number of yellows, ranging from "moderately fast" to "very fast," were to be found among the azo colors. Specially important were those in which salicylic acid was a constituent element, since not only did this impart to the color the power of forming more or less stable lakes with chromium and aluminum mordants, but it appeared frequently to give the colors the quality of fastness to light, even when no mordant was applied. The colors obtained with aluminum were practically as fast as those fixed with chromium, since the first named mordant gave much brighter and purer yellows. The tin mordant, so useful in the production of the most brilliant orange and yellow colors obtainable from the natural coloring matters, seemed, however, to be of little or no advantage in connection with most of these azo-mordant colors, no doubt because they were susceptible to the reducing action of the mordant usually employed for wool—viz., stannous chloride.

Very interesting in point of fastness to light were the azoxy colors, and although, unfortunately, apt to dye wool somewhat irregularly, giving speckled looking colors, they were admirably adapted for silk and cotton.

Another interesting little group was that which includes tartrazin, a color not only noteworthy for its fastness to light, but also because of its brilliancy and purity. The fastness of alizarin orange was worthy of special mention, for it was probably greater even than that exhibited by most other colors of the alizarin group, and it showed the peculiar darkening action exerted by the light, probably in consequence of the presence of the nitro group. It was remarkable how few really fast yellows were derived from the natural coloring matters, and these were chiefly the olive yellows obtained with chromium mordant. The only fast, and, at the same time, bright, natural yellows, were those derived from weld, and since the dye stuff was now of little general importance to the dyer, its cultivation had become extremely limited, and was gradually being given up. It was fortunate, therefore, that science had been able to replace it by efficient substitutes, so far, at least, as permanency towards light was concerned. The experiments had already abundantly proved that the popular opinion that the coal tar dye stuffs included only such as yielded more or less fugitive colors, was entirely false; indeed, it was perfectly safe to assume that coal tar was the source from which the greatest number of colors fast to light were derived at the present time, and this seemed to be specially true of the red and yellow colors.

[Continued from page 298.]

Photometry.

[The second of a series of lectures delivered before the British Society of Arts, by Capt. W. de W. Abney, F.R.S.]

I omitted, from want of space, to say in my last lecture that the fact that a flame viewed end on is from 10 to 35 per cent. less luminous than when viewed sideways. Fig. 1 gives a measurement if taken with

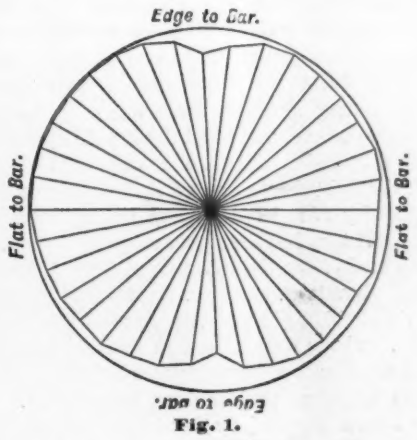


Fig. 1.

a flame at different angles to the screen according to Mr. Dibdin. The variation in the light of a burning candle has been shown you, and I think that for scientific working it must be dismissed as unworthy of serious consideration. There are only three what I might call feeble light standards which I shall refer to, viz., the amylacetat› lamp, due to Hefner Alteneck; the pentane illuminant, and the ether illuminant. I put the amylacetate lamp first, not because of its superiority, but because it requires such little manipulation. This is a lamp which is a great favorite of mine, because it is so accordant in its results. It consists of a tube of German silver 8 mm. in diameter and 25 mm. high. The flame is 40 millimeters high, and when it has been burnt for five minutes the flame remains of a constant height. It burns amylacetate, but it is not necessary to use this compound, as any similar one will consume as well. Hefner Alteneck gives a table of the results of the different compounds and their comparative luminosities:

	Constitution.	Per Cent. of Carbon.	Boiling Point.	Intensity of Light.	Time for the Combustion of 1 Gramme of the Substance	Carbon Consum'd in 100 Seconds.
Valeriate of amyl....	$C_{10}H_{20}O_2$	69.7	195° C.	1.03	430	0.162
Acetate of amyle....	$C_7H_{14}O_2$	64.6	138°	1.00	388	0.166
Formiate of amyl ...	$C_6H_{12}O_2$	62.1	122°	1.01	372	0.163
Acetate of isobutyl ..	$C_6H_{12}O_2$	62.1	116°	0.99	373	0.163
Formiate of isobutyl.	$C_5H_{10}O_2$	58.8	98°	0.97	355	0.166

The drawback to this lamp, as originally constructed, is that the metal takes a green deposit, which is tiresome; if it be plated with silver, this disappears.

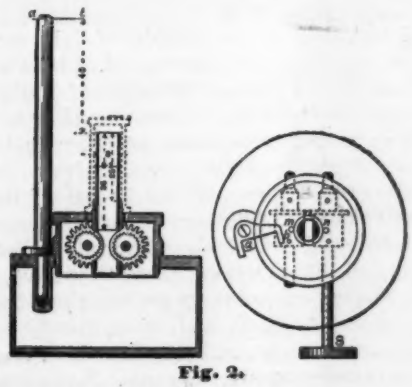


Fig. 2.

Dibdin's pentane Argand, which burns pentane, is the next one to refer to, and is the lamp which appears to me most perfectly to utilize the pentane, employed as an illuminant, is a simple method. Pentane is a hydrocarbon of the paraffine series, but is not perfectly pure at all times. The illuminant is air passed over a carbureter containing the pentane. The height of the flame is 3 inches, $\frac{7}{10}$ths of which are cut off by a screen at the top. By these means a standard flame is obtained, which is equal to 10 candles. The great point in this is that the height of the flame does not affect the result, at least it does not to the eye. Temperature has no effect on the result, as Mr. Dibdin has thoroughly tried.

The next standard is a very simple one, introduced by Mr. Dibdin more especially for photographic purposes; ether, instead of pentane, is burnt in a pentane lamp, and gives a very fine light. Photographs taken with these two lights at different heights of flame, but at the same visual intensity, do not give quite the same photographic effect, so that there is a deviation from the definition of perfect standard.

We have seen what kind of a light we must use for photometry as to quality and quantity. Now we come to photometers. The photometry we will first consider is the comparison of two lights together. How are we to compare two lights? There is one evident way, and that is to place side by side two white surfaces which are illuminated by the two lights. This is the principle of Rumford's photometer and nothing else. We are usually told that it is the method of shadows—the comparison shadows one with the other. Now it is nothing of the kind; it is really the illumination of a surface by two distinct lights, the one illumination being not interfered with by the other, and this is secured by making one light cast a shadow of a rod on the screen, which is illuminated by the other, and this last light to cast a shadow of the same rod at a different place, which is illuminated by the first light. These two illuminated surfaces can be made to touch by moving the rod or the angle of the light, and by various plans these can be equalized in brightness. No less a distinguished authority on photometry than Mr. Dibdin, in an excellent book he has written, says, although this method has certain advantages, "the method is one which few practical photometrists of the present day would venture to adopt." Well, I am a tolerably practical photometrist myself, and I must confess I prefer it to any other kind of photometry, as it is simple, and very few errors can creep in if one is ordinarily careful, which is more than can be said of some others, as we shall see. One error that may be met with is that if the lights make a great angle with each other, and if the screen is not placed at right angles to the line bisecting the angle, an error may creep in.

Let me show you this experimentally, and this experiment really demonstrates another mode of photometry.

This white cube is placed between two lights, one of the right angles of the cube being towards you. I place a square aperture in front, so that it is bisected by the edge. The cube is rotated round that edge as a center, till the two sides appear equally illuminated. The reason of the equality of illumination is quite plain. It is because the side nearest the light is skewed at a greater angle than the other to it.

If we have a diagram, we shall see why this is. In Fig. 3, *A B* and *B C* are the two sides of the cube illuminated by rays *R'* and *R*. It is evident that the side *A B* will not receive so many rays as *B C*, in fact, the amounts are measured by *p q* and *m n*. If the lights are unequal, of course when the intensity of the one multiplied by *p q* is equal to the intensity of the other multiplied by *m n* the two will equal. The intensities, where a balance is struck, is found by taking the cosines of the angles through which the cube is turned.

We now see that light illuminating a surface varies as the cosine of the angle through which it is turned. If it be turned 5° more towards one light than the other it is evident that we shall get a variation. The amount would be as 1 to .996, or an error of $\frac{4}{1000}$, or $\frac{1}{250}$. If it were 10° it would be 1 to .984, or $\frac{16}{1000}$ or $\frac{1}{62}$ part, which would be appreciable.

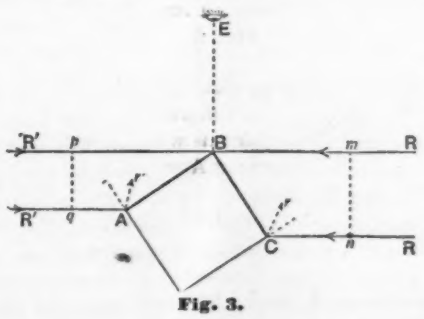


Fig. 3.

There is still one more error which might be felt, and that is that the eye receives more light when the angle which the screen makes with the eye and the source of light is greater than a right angle (see *r* and *r'* in Fig. 3). This must always be the case, but what may be called the difference in the spectacular reflection is so small for ordinary angles

that it is of the same order as that given for the wrong placing of the screen, and becomes practically negligible.

For great accuracy the illuminated shadows should touch, and if the lights be not too broad, there is no difficulty in causing this to be done; sometimes, however, a white line or a black line will separate the two owing to the penumbra of the shadows, and then making the illuminations of the two strips equal becomes more difficult. As the black line has greater contrast to the two illumined surfaces than the white line has, the former is the worst kind of line to put up with.

The next method that is adopted is what is known as the Bunsen method. It consists of equalizing the brightness of a greased spot in the center of a paper disc, or its total disappearance. The principle on which this is based is the translucence of the spot. If as much light goes through the spot (if perfectly made) from one light as goes through from the other, the spot is equally illuminated throughout its thickness, and appears the same whiteness as the paper. If it be greater on one side it will appear dark on one side, and lighter on the other. It is evident that with such a method every suspicion of stray light must be rigidly excluded, unless it be exactly the same on both sides of the disc, and only that coming directly from the sources of light utilized. Light reflected from the sides or bars will give fatal results as far as accuracy is concerned. I have met with some instruments in which reflections seem to have been encouraged rather than allayed. To my mind the method should not be accepted except in the hands of those who are thoroughly practical and scientific. I show the design of a Letheby photometer, kindly lent me by Mr. Sugg. [The instrument itself was in the lecture room, through Mr. Sugg's goodwill.] The grease spot is viewed on both sides by inclined mirrors, and when the grease spot disappears on both sides, or at all events appears to equally dim on each side, the light illuminating the spot may be said to be equal.

There is one thing to be noted, and that is that very much depends upon the kind and amount of grease and the kind of paper employed. I have made a good many grease spots in my day, and I have found the sensitiveness of my method vary considerably according to the attention paid to these details, but I have abandoned the method in my laboratory, except under special circumstances, in favor of the old Rumford method.

Mr. Dibdin, in his work, says:

"When first setting up a disc for use, special experimental readings should be taken; and if any material difference is found between the indications when one side or the other is turned towards the standard flame, it should unhesitatingly be rejected, as no amount of after allowance can compensate for the trouble and doubt arising from contradictory results. The disc should be clean and perfectly free from scratches or other markings of any kind; it is but sorry economy to work with a defective instrument. The Gas Referees went so far, a short time back, as to run a new disc, to be used every week. As, however, a good disc, when taken care of, will last much longer than that period, the point has not been insisted upon; but that is no excuse for the continued use of a defective one, which should be instantly destroyed as soon as detected."

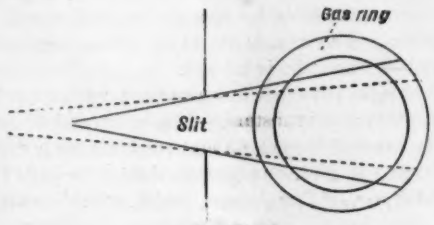


Fig. 4.

We see from this that a disc photometer is open to a very grave objection, and it is for this, if for no other reason, that I prefer the Rumford system, where there is no liability to err on this matter. A modification of the Rumford method of shadows is that employed by Prof. V. Harcourt. He casts his shadows on ordinary printing paper, rendered partially translucent by a wash of spermaceti dissolved in petroleum. Instead of a rod, and about three-quarters of an inch from the paper, he places a brass screen, having two rectangular apertures cut in it exactly their own breadth apart. The two lights are placed at equal angles on each side of the line perpendicular to the screen, and the illuminated shadows are caused to just touch one another. It will be noticed that really there are four shadows illuminated, one from one light being touched by the other two, and the fourth falling on an opaque or black space. A great advantage of this plan is that they are looked at from the back of the screen, no rod being between the eye and the screen. If two lights of approximately the same color are looked at, the fact that the light has to traverse the paper is of no moment, though, when colored lights have to be compressed, there is a danger of absorption slightly altering the values that should be obtained.

Before quitting the subject of the Bunsen method, I ought to mention that in photometry, for the grease spot is sometimes substituted a star of thin paper, sandwiched between thicker paper; that is known as a Leeson disc, and has been much improved by Mr. Dibdin.

Methven proposed to use a slit placed in front of an Argand gas jet as a regulator, if I may call it so, of the quantity of light issuing onto the grease spot. This appears at first sight an admirable arrangement, and it would answer well if the grease spot were always kept at the same distance from the source of light, but when it is moved, an error, though it may be very small, must be introduced. An Argand flame is practically a hollow cylinder of light of a certain thickness. (Fig. 4.) As you approach the light the section of the cylinder varies, and consequently the quantity of light falling on the spot must vary beyond what it should do. It may be remarked that putting aside this error the measurements are made from the slit and not from the source of light, which is a decided advantage. Messrs. Hurter and Driffield have to a large extent got rid of this light and employ a flat flame of large size as the source of light, and use a small square aperture in front of the flat side. As the section of such a flame appears to be uniform, the inaccuracy of measurement introduced is done away with. In reference to this, it may be interesting to show that in an ordinary flame the light varies in intensity at different points. This can be done well by means of photography, reducing the exposure each time. Fig. 5 is an Argand burner flame, Fig. 6 a batswing, and Fig. 7 an ordinary candle.

It will be seen that in the candle flame we have an almost expected result. The Argand gas is more surprising. The batswing gas is perhaps the best, as it shows that in the wing used the intensity remains almost constant. I think these photographs will demonstrate to you that if the quantity of light to be admitted to a screen is to be determined by an aperture, the burner should be of the batswing type.

Before quitting the subject of photometers, I must introduce to your notice the radial photometer of Dibdin (Fig. 8). The diagram almost explains itself. The object of the photometer is to measure the illumination of a flame in all directions. It will be seen that the arm which carries the light to be tried remains always at the same distance from the screen. The screen itself is so arranged that its surface bisects the angles between the lines joining the two lights and itself—a most necessary thing, when Fig. 3 is taken into consideration.

We have now to turn to the method of judging the equality of light; that is, how the eye can best appreciate the light.

We are told very frequently that the eye can appreciate about the $\frac{1}{100}$ part in the intensity of light, or, say, 2 per cent. There is a story told of a celebrated witness who, when asked whether such and such a thing was the case, said: "Yes and no." Now if I were asked the question whether the above limit was true, I could safely answer in the same terms. First of all let me show you an experiment, which will prove that this limit is both understated and also overstated. I have on this screen a variety of grays between black and white. We can now see them all, and the difference between them. If I turn down the light, a great many of these appear the same tint. If I turn on to them a very strong electric light, those not nearly white, when looked at from where I am, appear white, and it is only when there is considerable black in the shade of tint that they appear gray.

As a matter of fact, there is an intensity of light, in which much smaller differences than the $\frac{1}{100}$ can be perceived. I believe, for my own part, that, when the light is suitable, a difference of nearly $\frac{1}{200}$ is recognizable. But it is not necessary that the eye should be so sensitive as the above, so long as proper precautions are taken in balancing the light. If we balance from "too light" and then from "too dark," the mean will be fairly exact, and probably not be far off the truth by a good deal less than 1 per cent. But there is another plan, which is better still, and that is by rapid oscillations in intensity on each side of the true point. This is difficult with many photometers, but not with all. When this plan is adopted, supposing we are using the shadow method, the two shadows appear to *wink*, and, when exactly balanced, this winking stops. It is curious how, without this artifice, readings, which can be proved to be palpably wrong, are made. For instance, when one shadow is intensely darker than another, the eye of the observer will fail to see it, when the alteration is made slowly. If the eye, however, has a rest, by looking away at some black object, the inequality of the shadows will at once be seen. This cannot happen when the method of rapid oscillation is adopted.

What the cause of this may be is not absolutely proved. When the eyes look at two objects (spots or shadows) the images of the two are projected on different parts of the eye, these portions get fatigued, and the longer they are looked at the greater the fatigue. The brightness of the two gets lowered and they gradually approach one another. When the system of oscillation is adopted, though both images are lowered in tone, yet there is a constant brightening and dimming in both, not sufficiently rapid to make each of them practically uniform in a tone midway between the two, but scintillation is produced. We can see how the eyes can be fatigued by a very simple experiment. I will throw a bright patch from the electric light upon the screen, which is also partially illuminated by gas light. If the audience look at it for a few seconds, and keep their eyes fixed on the screen when I cut off the electric light, they will see a dark spot where the bright patch was, and it will appear to travel about as the eye wanders over the screen. This shows that the part of the retina on which the white patch was received is fatigued, and is less sensitive to the feeble gas light illumination with which the screen is illuminated.

Fig. 5.

Fig. 6.

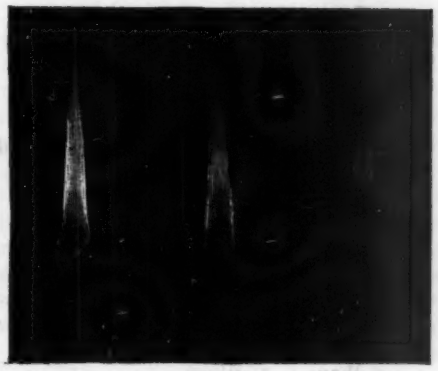


Fig. 7.

Some very instructive measures of the sensitiveness of the eye to different shades of light can be made by a sector arrangement. Black dots of any size required (in the case in point they have one-eighth of an inch in diameter) can be placed on a white disc, as shown. This disc is cut radially from the center, and a black disc is marked out in the figure. The proportion of black and white can be altered at pleasure, and a further slight alteration in the gray produced is made by the dots; the smallest alteration, of course, being when the dot subtends the smallest angle. By this plan the sensitiveness of the eye to any small change in light can at once be found. The sector may be varied between all white to nearly all black. Similarly, white dots may be placed on a black disc, a white disc overlapping, and unique measures made. It must be remembered that in all cases the black itself reflects a certain amount (in this case about 4 per cent.) of white light.

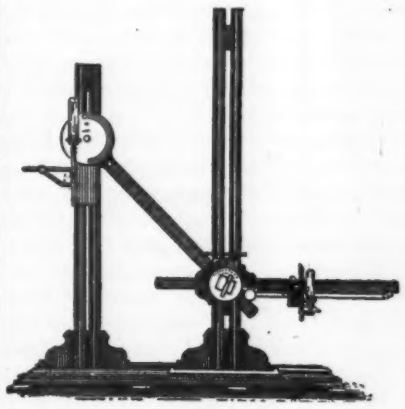


Fig. 8.

Fig. 9.

(To be Continued.)

Use of Peat for Fuel in Germany.

The United States Consul at Bamberg says, in his last report, that the numerous inquiries that have been addressed to him on the subject of cheap fuel, have caused him to give careful attention to the process by which many parts of the G rman Empire secure their supplies of that comparatively inexpensive, but yet satisfactory, fuel—peat or turf. Peat or turf is used throughout Europe generally, wherein the ordinary cost of its production is not materially increased by cost of transportation. In the large and small cities, as well as in the country districts, it is used for fuel ; in fact, in many localities it is the only substance used for heating purposes. Peat is the product of decayed organic matter. The main cause of the transformation of vegetable substances into peat is water of a certain composition and temperature which, being almost still or flowing slowly in or above the earth, permits of the development of swamp plants, and, at the same time, preserves the latter from total decomposition, by reason of exclusion of the air. These conditions are found to exist more particularly in the temperate zone, where the necessary variations of temperature occur, and where tracts of land are found whose impervious beds lead to continual accumulations of water, while, on the other hand, other portions of territory with loose and penetrable beds, especially in regions inundated by the overflowing of rivers, are subjected periodically or continuously to an extraordinary saturation. The various theories that have heretofore been advanced to account for the origin and development of peat bogs, generally agree that the moors are the product of a more or less extensive decay of certain plants in a mass of vegetation which, under favorable conditions as regards locality, climate and moisture, is continually being renewed in one section and matured in another. The upper layer of peat or turf, which consists for the greater part of varieties of moss, is, when broken into fragments, a loose fibrous substance—a mixture of root fibers, leaves, stems, etc. The bottom layer, known as *pechtorf* or *specktorf* ("pitch turf,") consists of a black, compact, pitchy mass, which shrinks rapidly on being separated into small pieces. It has, when cut evenly, a smooth wax-like surface, contains the greatest amount of nitrogen, and, consequently, is the most valuable for heating purposes. Every rational operation of peat bogs or moors must be begun by the draining of the territory to be worked, and this draining must be undertaken sufficiently in advance of the working of the peat moor itself, in order that the territory in question may attain the requisite degree of dryness. Even after this has been effected, the peat still contains water in quantity equal to from 70 to 80 per cent. of its weight, and this remaining moisture is then almost entirely removed by successive processes of drying in the air, manipulation with machinery, or subjection to artificial heat. Until within the last few years, manual labor has been employed to work the peat bogs, but a very ingenious machine has been invented to take its place. This machine consists of three lancet-like knives, which, by operation of a toothed rod, cogwheel and crank, are sunk into the peat, cutting out a square piece, which is received upon a horizontally working shelf and removed by a simple reversing of the above mentioned contrivance. Another method consists in plowing and har-

rowing the bog or moor by the use of steam power and wire cables, the material for which is manufactured at Mannhein. The process of drying the peat or turf, in so far as small moors are concerned, consists simply of exposure to the open air. When extensive territories are worked, artificial drying is resorted to, and the expense involved in the latter operation is by far the greatest incurred in the production of peat. In Germany the following kinds of peat are known: Cut peat, which is cut into the form of bricks by hand spades or special machines; moulded peat, which is produced by cutting the peat moss into irregular pieces, mixing it with water and then moulding it into the respective forms; machine or pressed peat, which is the result of pressing the turf, after previous separation into pieces and drying in ovens. In the category of "machine peat" is also included the so-called "ball peat" (*kugeltorf*)—globes of turf about 4 inches in diameter, made by passing the turf pulp through specially contrived appliances. In the district of Bamberg, the moor to be worked is first freed from vegetation, leveled, plowed and harrowed, and the loosened peat broken, so as to be exposed to the action of the air. It is then gathered by means of a kind of snow plow, brought to the separating machine, taken thence to the drying oven and the press, whence it issues in the shape of smooth, shiny, dark brown bricks. A machine in operation at one of the chief peat works in Germany produces, provided suitable material is used, from 10,000 to 15,000 bricks in 10 hours. Another machine, requiring 6-horse power to work it, can produce from 60,000 to 100,000 bricks a day. In Germany the relative cost of peat as compared with hard coal is as follows; 100 kilogrammes (kilogramme = 2.2 lbs.) of good Zivickau hard coal cost at the mine 1.20 to 1.62 marks (mark = 25 cents), while the cost of production of the same quantity of peat amounts to from 0.30 to 1.40 marks, according to quality. Besides its use as fuel, peat is turned into account in Germany as a fertilizer and as building material, it being successfully used as a filter for vacant spaces, separating layers for waterworks, reservoirs, ice houses, etc. By means of a process patented by a tanner in Mayence, it has also been made to do service in tanneries. The waste or superfluous particles of peat, known as peat dust, have recently been brought into extensive use as a material for fitting up and preserving odorless vaults, an innovation, says Consul Stern, deserving strong commendation, especially in localities where the sewerage is inadequate. Hanover and Mecklenburg alone have from 140 to 150 square miles, and Bavaria has 22 square miles of peat moors.

The Hunting of Governed Engines.

Mr. Jas Swinburne, of the British Institute of Civil Engineers, notes that Lord Rayleigh, in a paper read before the Royal Institution on March 15, 1878, pointed out that the ordinary explanation of the action of the electro-magnet in an electrically driven tuning fork is incorrect, and that such a mechanism works in virtue of the self-induction of the electro-magnet. As far as the action of the contact goes, it is the same whether the leg of the fork is receding from the magnet or approaching it; and if the force depended only on the contact, and was symmetrical, no power would be supplied to the system. It would be like a pendulum which is acted upon by gravity equally whether the bob is going up or coming down. To make the pendulum work continuously, gravity would have to act more when the bob was coming down. As this cannot be arranged, a clock has to do the work instead. In the case of Lord Rayleigh's tuning fork, the magnet pulls harder when the leg is coming towards it than when receding, and thus gives power to the fork. In other words, the effect of the magnet lags, and thus becomes unsymmetrical. This is a most important principle, and it applies to a large number of varied cases of great importance, and of more interest to engineers than even electrically driven tuning forks. Broadly speaking, all kinds of continued vibration may be said to depend on this principle, including the hunting of engines.

If a governor really behaved as it does in most text books, and admitted steam in exact accordance with the speed of the engine, there would be no such hunting; but unfortunately a governor does not follow the variations of speed instantaneously. Apart altogether from questions of friction, or movement of heavy valve or expansion gears, many forms of governor, especially what may be described as the relay kind, alter the steam admission with some delay. The friction of the various parts and their tendency to remain in one position until the disturbing force comes up to a certain value, and to then move suddenly and overshoot the mark, increases this action. The result of this time lag in the action of governors is that in many cases engines, especially on light loads, get into a state of vibration known as hunting.

The orthodox way of treating such a subject would be to begin with the discussion of an engine with a flywheel and a frictionless governor with a dashpot or something of the sort, following a simple law. A system might thus be imagined which would fit a differential equation such as that used to find the current when an electrical condenser is discharged through an inductive circuit; and it might be possible to calculate the load which would just prevent permanent hunting, or any hunting at all. There are immense difficulties, however, for there are so many small causes of disturbance that such treatment would probably give no useful information. It may be best, therefore, to discuss the question verbally only, without expecting to arrive at very definite results.

When the load of an engine varies, for instance, by decreasing, if the steam supply remains the same, the extra energy goes to increasing the speed of the flywheel. Whether the speed of the engine follows the steam supply quickly or not thus depends on the flywheel. It also depends on the load. If a 1,000-horse power engine is working at full load, and 900-horse power is suddenly thrown off, and the governor does not act instantly, 900-horse power is devoted to increasing the velocity of the flywheel, and unless the wheel has an enormous moment of inertia, or is turning very quickly, this power will increase its speed, say, 2 per cent. in a very short time. On the other hand, if the engine is only doing 100-horse power, and this load is suddenly reduced to 10, there is only 90 to increase the speed of the flywheel, and to increase it 2 per cent. will take 10 times as long as in the former case. Putting the matter the other way, the engine obeys variations of steam supply more slowly at light loads, or, in other words, it obeys its governor more tardily at light loads. In practice many engines which run steadily at full load, hunt terribly when worked light.

Turn now to the governor. It is generally treated as complete in itself, without reference to the flywheel or engine load. A simple Watt governor, and most of the governors on small engines, have no appreciable time lag, except a certain sticking, due to friction, or to the absurd practice of putting a comparatively small governor to work direct on to a heavy expansion gear, or a stiff stuffing box. These matters have been discussed in an able paper by Ransom recently. There is not very much tendency to hunting with such governors. Their drawback is that as the steam must be nearly shut off at no load, and full on at full load, the valve gear must be in different positions, and the governor must therefore be in different positions too. This means that the engine will be governed at a considerably higher speed at light loads. To cure this the obvious course is to make the governor isochronous. The drawback to this is that an ordinary isochronous governor is not powerful enough if it has to move through a long range with a very small percentage of speed variation. It is likely to stick until the speed has varied a good deal, and then to move to its fullest extent. The result of this would be that the engine would be governed by having full steam and none at all alternately. I do not know why this method of governing should not be employed. If the governor works some light gear, such as the various modifications of the Corliss, this form of governor should work very well with a large flywheel. The cylinder would either get a charge of steam which would correspond to the full engine load, and which would, therefore, be expanded and worked in an economical way, or it would get none. This alteration of full load and no load is common in gas engines, and, for distinction, may be called the hit-and-miss method of governing. The only steam engine I know which employs it is the Parsons steam turbine. Of course, the great difficulty is the flywheel, especially in a slow speed engine. If working at a tenth of its load it gets steam only every tenth revolution, and the flywheel must carry it round for nine. As high speeds are gradually coming in, it may be worth while to keep this method of government in mind, as it is most economical of steam, and as there is no time lag in the governor, there is no hunting.

Returning to the isochronous governor, the obvious method of overcoming the friction or weight of valve gear is to use some relay—to use a convenient electrical expression. The governor does not then act directly on the valve gear, but puts some screw or other mechanism into gear, which works the expansion or throttle valve. Willans used a water relay. The governor worked a minute water valve, controlling a cylinder which worked the throttle valve. Such an arrangement can be made very accurate, as a very small movement of the governor, opposed by a very slight force, can be made to work the most obstinate valve gear. But we have at once danger from hunting, as there is considerable time lag in the governor. Suppose the load is suddenly decreased, the engine speeds up and the governor begins to increase the expansion, but effects this slowly, and by the time the valves are right for the reduced load, the engine is much above speed. The governor, therefore, goes on reducing the steam until the engine has far too little. It, therefore, slows down again. But the governor continues reducing

the steam until the engine is slowed down to its normal speed. By that time the engine has far too little steam, so it goes on falling in speed. The governor then begins to turn on steam again, but it does it so slowly that the engine has fallen far below speed before the normal steam supply is given, and the governor goes on turning up steam till the engine arrives at its normal speed, when it has far too much steam, and is again rapidly increasing in speed. The cycle of operation is repeated over and over again. It depends on the lag of the governor, the flywheel, and the load, whether the hunting is temporary, so that the variations of speed are less and less every time; or permanent, in which case the engine alternates between no steam and, perhaps, full supply. An engine which hunts permanently at very light loads often works perfectly over half load.

An ordinary governor is thus apt to be insensitive and to allow the speed to vary with the load if designed not to hunt; and if arranged to work a relay, hunting results. An isochronous governor with a dashpot has, of course, a time lag too.

It is easy to make a governor which combines the advantages of both systems and avoids the drawbacks.

A governor made by Messrs. Weyher, Richmond & Co., of Pontin, may be cited as a good example. It is not isochronous, and it works directly on the steam control. I may mention that even in small engines the French arrange the valve gear so that it is very easily controlled. The variable detent is very common. In addition to working the steam control direct, any movement of the balls from the normal position puts a screw gear into motion, which slowly alters the intermediate gear, so that the engine finally runs at the normal speed whatever the load is. It is unnecessary to describe the particular gear employed; a typical case may be imagined. Suppose the expansion link is in connection with the middle of a lever, and the governor with one end *A*, the other end *B* being fixed; an increase of speed raises the end *A* of the lever and the middle, and you have an ordinary non-isochronous governor which gives a higher speed at light loads. Suppose, however, that any rise of the end *A* of the lever sets a train to work which slowly raises the other end, it will go on till the governor is in its normal position. We thus get a governor which does not hunt and gives the same speed at all loads. If the valve gear is heavy or stiff, the governor may work one end of the lever by means of a relay, but it must be a following relay, such as those employed in steam steering gear, so that the extent as well as the direction of the movement of the governor end of the lever is controlled by the position of the governor; and this gear should act as promptly as possible to avoid hunting. The other or relay gear then works slowly. In such a governor it will be seen that the end *A* of the lever eventually comes to its normal position in all cases, and only moves to counteract sudden variations of speed. The real control is effected by the slow-moving relay moving the other end *B*.

Instead of using one governor, a pair may be employed, one of which works direct on the valve gear, and the other by means of a slow-working relay. This method does not seem so simple as using a simple governor to do both.

These matters must have been worked out thoroughly by many engineers, and they appear so simple that one almost feels ashamed to bring them forward here; but in looking the matter up I find the governor is generally treated by itself, without reference to the engine. I have, therefore, thought it might be worth while to bring this subject forward, and trust you will bear with me for having put it in such a very elementary way.

Production and Consumption of Platinum.

By Mr. B. T. Vetterlein.

With the introduction of the electric lamp into practical use in 1881, the consumption of platinum rapidly increased, though the quantity required for each lamp was gradually reduced. The first Edison lamp contained .8162 grains (53 mg.) platinum; the first Sawyer-Man over 1.52 grains (150 mg.); the former now barely contains .1232 (8 mg.) grains, and the latter none at all. Likewise Siemens and Halske have reduced the quantity in their lamps to a minimum. Notwithstanding the consumption of platinum for electric lamps has risen in 1892 to 3,758.843 pounds (1,705 kg.). Whatever has been or may be done to dispense with its use in electric lamps, its entire abandonment is improbable, since the many lamp factories are arranged to make use of it and the cost is but a trifling addition to that of the completed lamp; it is therefore more likely that the future consumption for this purpose will be rather larger than less, due to the increased demand for lamps.

Two other important uses for platinum absorb very considerable amounts. One is the construction of vitriol concentration stills, and the other dentistry. It is estimated that (2,480 kg.) 5,467.408 pounds per annum are required for these two industries in Germany. The manufacture of acid appears also to be on the increase, and though to some extent glass has been substituted for it, the general belief is, that more and more platinum will be required. It may also be assumed that dentists will always continue to use it, since it is the only metal which combines the greatest infusibility with flexibility and strength. In England and America alone 4,100.556 pounds (1,860 kg.) are used, and the quantity increases yearly from 2 to 3 per cent. For crucibles and the like at least (620 kg.) 1,366.852 pounds are required. To recapitulate, there will be needed for all purposes at the present moment:

For lamps.....	3,759 lbs.	1,705 kg.
For stills and dentistry.	9,568 "	3,840 "
For crucibles, etc.....	1,367 "	620 "
	14,694 lbs.	6,165 kg.

This amount, to the extent of 30 to 40 per cent., is covered by old platinum, leaving from (3,705 to 4,316 kgs.) 8,817 to 10,286 pounds to be provided.

For many years the Ural mines supplied the largest proportion (92 per cent.); but how long will this continue? According to the official statistics of the Russian Government, the production of platinum reached its height in 1887; then it fell to 5,952 pounds (2,700 kgs.), and remained without change at these figures till 1891, in which year, owing to the abnormally high prices current, it rose to (4,226 kgs.) 9,317 pounds. But many of the Ural mines are now exhausted, and it is believed that the culmination point of the Russian platinum production has passed. New sources of supply have been looked for, and it is hoped that these have been found in Colombia, S. A.; British Columbia, and in the United States. As yet the production in Colombia amounts to a little more than (125 kgs.) 276 lbs., obtained by placer mining. The platinum bearing territory is very extensive, though not rich, and is in part well adapted for placer mining. Considerable American capital has been invested there, and it is among the possibilities that this country may become an important producer. In British Columbia, the only appreciable finds have been made near the Talamee river, but only about (25 kgs.) 55 pounds have thus far been credited to this section. In the United States many attempts have been made to find platinum. In the California and Oregon placer mines it has been found. The census bureau returns the amount for the years from 1880 to 1889 at 2,491 Troy ounces, and for 1892 at 80 ounces. The imports into the United States, according to the same source, foot up for 1890, at 123,143 ounces, and for 1892, to 86,000 ounces.

Electricity in Mines.

The conclusions reached by Mr. W. E. Lishman, as published by him in a paper contributed to the "Journal of the British Society of Mining Students," on the above-named matter, are that it seems probable that in the future the alternate current will be more extensively used, the obstacle at present in the way being the difficulty there is in starting the motors. Economy in transmission will be further increased by the introduction (with sufficient precautions) of high tension currents and the use of transformers, which in some cases are already employed. The current is taken along the main cables at a high potential, and at the required points is transformed into one of low potential and large current. In every machine which is used for the purpose of converting energy in one form into energy in another more adapted for service, the transformed energy, or the energy realized, is never so great as that originally given out; and since, by the doctrine of "conservation of energy," none is ever lost, but only reappears in some other form, the difference between the energy employed and that realized is either expended in doing work in the process of conversion or dissipated in some other form, owing to the want of proper means of concentrating it into the desired channel.

This loss (loss so far as the desired end is concerned) must exist so long as there is work to be done in the process of conversion, but it can be reduced to a minimum, and the nearer the realized energy approaches that originally given out the more efficient is the process. Friction, in ordinary machines, is accountable for absorbing much of the power, but with electricity, as seen above, there are other losses, and a more ready way of obtaining the current is to be looked for in the future. When heat, which is so readily obtained from electricity, can be as readily reconverted into electricity without the introduction of all the machinery at present necessary, and the friction consequent upon it, economy will be still further increased and efficiency will approach a maximum. At present this is in its experimental stage, but there seems ground for believing that it will eventually become practicable,

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

A QUEER provision in the city charter (section No. 221) of Niagara Falls, N. Y., directs that all gas and water connections from the street mains shall be made with lead pipe. The practice, however, has been to disregard the rule in so far as it relates to gas connections.

MR. DENIS POITRAS, a prominent resident of Montreal, has instituted a suit against the Montreal Gas Company to recover a sum of money which he avers was illegally collected from him by the defendant. He says that the Company, under its contract with the city, agreed to furnish gas from 1885 to 1890 at the rate of $1.45 per 1,000 cubic feet, and from 1890 to 1895 at the rate of $1.40 per 1,000 cubic feet. During the last named period the Company charged $1.40, less 10 per cent., to consumers residing east of Cathedral street, whereas consumers living west of Cathedral street have only been charged 95 cents, the difference in the rate being attributable to the competition existing in the western district between the Montreal Company and the Consumers Company. Complainant sues to recover the 32 per cent. which he claims was an overcharge, because according to its charter and its contract with the city the Montreal Gas Company has no right to make unfavorable distinctions between the residents of the city.

ACCORDING to advices from Port Jervis, N. Y., the plant and franchises of the Port Jervis Gas Light Company have been sold to a syndicate comprising Messrs. Geo. F. Duncan, Geo. P. Westcott and Geo. F. West of Portland, Me., and Messrs. R. E. Schofield, W. E. Scott and Dr. W. L. Cuddeback, of Port Jervis, by whom it will hereafter be operated. The Portland parties were represented in the negotiations by Mr. Geo. F. Duncan, and his associates are interested in the gas works at Biddeford and Saco, Me., and other places. Mr. West, who is the practical gas man of the concern, will have general supervision of the works, and it is probable that Mr. Fullager, the former lessee of the works, will be retained in the employment of the Company. It is the intention of the proprietors to enlarge the plant and improve the service at a probable expenditure of $15,000. The executive management of the Company is as follows: Directors, Geo. F. Duncan and E. C. Hursey, of Portland, Me., and W. E. Scott, R. E. Schofield and W. L. Cuddeback; President and Treasurer, Geo. F. Duncan; Secretary, R. E. Schofield.

THE power station for the Hartford (Conn.) Street Railway Company will be designed and built by the Berlin Iron Bridge Company, of East Berlin, Conn. It will be 65 feet wide and 233 feet in length, with a steel frame covered with the Berlin Iron Bridge Company's patent anti-condensation corrugated iron covering. When completed it will be one of the most complete stations of the kind in the country, and will be absolutely fireproof.

THE Northwestern Electric Light and Power Company, of Chicago, is in the hands of an assignee—Mr. Wm. L. Abbott. The concern will be permanently wound up. The failure is attributable to competition with the local Edison Company.

AT the annual meeting of the shareholders of the Greenwich (Conn.) Gas and Electric Light Company the officers chosen were: Directors, Noah C. Rogers, James McCutcheon, J. Dayton, Wm. J. Smith and R. J. Walsh; President and Treasurer, N. C. Rogers; Vice-President, James McCutcheon; Secretary, J. F. Walsh.

"OBSERVER" forwards the following, under date of August 25: "The Massachusetts Board of Gas and Electric Light Commissioners has received numerous applications from the Companies under its supervision for approval of issues of stocks and bonds, which applications are compelled by the new law. The first case under the law was the application filed by the Waltham Gas Light Company to issue $20,000 bonds for the purpose of refunding a loan of that amount which was about to mature. The application was heard on August 21, and the Board has issued a decision authorizing the emission of $20,000 bonds, to run not more than 10 years, at 5 per cent. interest. During the past week the petition of the Westfield Gas Light Company for authority to issue $20,000 new stock, for the purpose of paying off debts, was heard, and the Board took the matter under advisement. An application is also in hand from the new Natick Gas and Electric Company, for leave to issue $125,000 stock and $125,000 bonds for the purpose of purchasing the Natick Gas Company and the Natick Electric Company, and also the property of the Elliott Falls Electric Light Company. The hearing on the last petition will be given on Sept. 4, at 2 P.M."

A WEEK ago we made brief mention of the fact that Judge De Lorimier had granted a writ of injunction in the case of the Montreal Gas Company against the Consumers Gas Company, the city of Montreal also being impleaded with the defendant, by virtue of which grant the Consumers Company was ordered to stop the distribution of gas within the limits of the city until May, 1895. The following *resume* of the case is taken from the Montreal *Herald:*

"Plaintiffs allege that the city gave them the exclusive right to supply gas to citizens until May, 1895, by allowing them to lay pipes in the streets of the city. The Consumers Gas Company, before the expiry of the contract made between the city and the plaintiffs, began to supply gas in the city limits. A writ of injunction was therefore demanded. The city declared it would abide by the decision of the Court. The Consumers Gas Company, in answer to a petition for a writ, alleged that the demand was unfounded:

"*First.*—Because it appeared that the only motive of the demand was the violation of the terms of a contract, made by the city and plaintiffs, a contract to which the defendants were not parties.

"*Second.*—Because there was nothing in the demand to show that a contract existed, and because there is nothing binding in law between plaintiffs and defendants.

"*Third.*—Because the demand showed no reason why a writ should issue.

"A second answer-in-law alleged that no demand could be made for $25,000, otherwise than by an ordinary action at law. A third answer denied all the allegations of plaintiffs' demand. A fourth denied the exclusive right of plaintiffs to supply gas in the city, because it was beyond the power of the city, and even beyond the power of the Legislature to grant such a monopoly. A fifth answer-in-law alleged that the defendants received their powers from the Standard Light and Power Company, and this latter obtained the authorization of the Quebec Legislature to lay pipes and sell gas throughout the Province, regardless of Municipal control. Art. 1033, Sec. 3 of the Code of Civil Procedure says that the Court may grant the issue of a writ of injunction to stop certain works under certain circumstances, and the third section that the Court may order this cessation when there has been a violation of a written contract. The Court held this to be formal, and as the article was intended to protect injured persons, it follows that the interpretation of the article must be liberal. The law was not limited to contracting parties alone, and its application has been left to the discretion and prudence of the courts. Interest is the measure of actions, and the law must be taken in conformity with this principle; therefore, the benefit of the law should be given to persons who suffer irreparable damages. Plaintiffs produced the contracts of John Coates & Co., who transferred to the defendant, and this contract showed that defendants violated their obligations. The first answer-in-law was consequently dismissed. As the contestants withdrew their demand for damages, the Court did not pass judgment on the second answer-in-law, but simply gave effect to the consent of the parties that the demand be withdrawn. In regard to the third answer, the Court held that the city gave the Montreal Gas Company the exclusive right to sell gas during 10 years till May, 1895. During the last two years another Company could be allowed to lay pipes, but such other Company could not supply gas. The city has the control of the streets and may say what use shall be made of them for the greater benefit of citizens. The Council had a perfect right, therefore, to grant an exclusive and temporary right to plaintiffs. This is not an illegal monopoly. The city cannot prevent the sale of gas within the city limits, but it may state how its streets may be used. No rights were given to Messrs. John Coates & Co. to supply gas in contravention of the clauses of the contract referred to; on the contrary, their contract expressly stated that they were only to supply gas on May 1, 1895, without hurting any rights that might have been acquired previous to that time. As the defendants only obtained permission to open the streets on certain conditions—that is, that they respect certain rights of the Montreal Gas Company, they cannot claim rights from the Standard Light and Power Company, because by common law commercial companies, chartered by Parlirment, are under municipal control. If the charter or statute does not state that they are withdrawn from the control, the Courts cannot withdraw them; were this done by the Courts it would not be interpreting the statute; it would extend the dispositions and clauses thereof. Moreover, existing rights cannot be withdrawn without an express statement to that effect; simple inference is not sufficient. Nothing was mentioned in the charter of the Standard Light and Power Company which could have with-

drawn the Company from municipal control, and it had to respect all acquired rights of other parties. As the defendants violated the rights of the Montreal Company by supplying gas within the limits of the city of Montreal, a peremptory writ of injunction must issue to restrain them. They are forbidden to use the streets of Montreal to supply gas till May, 1895."

THE New York agency of the Metric Metal Company, of Erie, Pa., is located in the salesrooms of the Bartlett Lamp Manufacturing Company, 40 College place. The telephone number of the establishment is "1,125 Cortlandt."

THE project for a gas and electric lighting supply for Pana, Ills., has been revived, this time by Messrs. C. H. Paddock, D. J. Overholt, J. C. McLuigg, W. W. Morrison, J. J. Connor, Aug. Rehrer and John Kahn, who have incorporated the Consumers Light Company. The initial capital is put at $5,000, the certificate of incorporation carrying the right to increase this sum as the needs of the Company may require. Pana is a post village in a similarly named township of Christian county, Ills., and can be reached by the Illinois Central, the Indianapolis and St. Louis, and the Springfield branch of the Ohio and Mississippi railroads. It is 42 miles southeast of Springfield and 35 miles south by west of Decatur. It has flouring mills, a foundry, machine shops, planing mills, grain elevators and other industrial establishments. Population, about 6,500.

MR. A. J. ROAT, of the West Side Gas Company, of Kingston, Pa., writes that the water gas apparatus constructed for the Company by the Economical Gas Apparatus Construction Company, of Toronto, Canada, is up to every claim that was made for it.

MR. CHARLES KRECKE, who recently secured the appointment of official gas inspector for Detroit, Mich., has returned home after an extended trip through the country, made for the purpose of investigating the manner and methods of conducting the different gas inspection stations. The stations which seemed to impress him most favorably were those conducted by Dr. Love, in New York, and by Dr. Ford, in the District of Columbia. The Detroit inspection station is to be fitted up in accordance with the latest practice. Under the ordinance, Inspector Krecke is directed to test the candle power of Detroit gas at least once a week.

THE Berlin Iron Bridge Company, of East Berlin, Conn., has received the contract for the new plant of the Fairfield Copper Company, at Monroe, Conn. The plant will be entirely of iron and steel, no woodwork being employed in the construction.

THE Cumberland (Md.) Gas Light Company's main system is being enlarged and extended; an improvement that will be valuable to the Company and beneficial to its consumers.

A recent issue of the Rochester (N. Y.) *Post-Express* says that some days ago Frank P. Crouch and wife transferred to the Rochester Gas and Electric Company lots Nos. 1 to 10 (inclusive), lots Nos. 19 to 21 (inclusive), on Freeman street, and lots Nos. 12 and A., on Redfield street; also certain described water front property. The purchase was made in the interest of the ammonia company recently incorporated with a capital of $15,000, which will at once construct a plant on the newly acquired premises.

THE following veto message which was recently sent by Mayor Matthews to the Board of Aldermen, of Boston, explains itself:

"Gentlemen—I return without my signature an order passed August 13, as follows: 'Ordered, That on and after the passage of this order no main pipe for extending any existing gas main shall be laid in any street of the city of Boston unless authorized by an order of the Board of Aldermen.'

"'And that all permits issued to the Brookline Gas Company for opening the streets in any part of Boston, other than that described in the contract now existing between the said city and said Gas Company, be revoked and cancelled.'

"This order is similar in many respects to an order passd February 5, 1894; it is open to the objections to that order set forth in a message dated February 16, 1894, and I can find no argument for its passage in the published proceedings of your honorable body. Permits are issued to the various gas companies to open streets outside of as well as within the territory covered by their respective contracts for public lights upon the theory—frequently explained in communications from this office and applicable to all the older gas companies doing business in this city—that the Legislature, which had supreme control over all the public ways in the Commonwealth, has granted to these companies the right to lay pipes throughout the territory specified in their respective charters, subject only to the obligation to procure the consent of the municipal authorities to the temporary street openings necessary for the purpose. These consents or permits were issued, if my information is correct, directly by the Board of Aldermen until the year 1853, when the practice was adopted of passing at the beginning of each year an order authorizing the Superintendent of Streets—a newly created official—to sign permits. This practice continued until 1883, when the authority up to that time annually granted to the Superintendent of Streets was vested in that official permanently, or at least indefinitely, by means of the standing regulations of the Board. These regulations have been renewed from time to time, and are still in force, unless, as seems probable, the entire control of temporary street openings was transferred by the charter amendments of 1885 to the Mayor, to be exercised through the officer charged by the city ordinances with the duty of keeping the streets in repair—that is, by the Superintendent of Streets. If this latter view is correct, it is, of course, impossible for the Board of Aldermen to reserve the jurisdiction over street openings exercised by it prior to 1853; but in any event no reason has been assigned for taking away from the Superintendent of Streets the control over street openings which has been exercised by that officer, either by virtue of the orders and regulations of the Board of Aldermen or under the city charter for more than 40 years. The gas companies are not allowed to dig up the streets at random or wherever they desire, and no favoritism or discrimination between the different companies is permitted. To each permits are given for all the streets within the territory covered by its contract for public lights, subject to the rule that no asphalt, brick, stone or concrete pavements shall be disturbed, and to the other reasonable regulations of the street department. Subject to the above conditions, permits have also been issued to the Boston, Roxbury and Brookline Gas Light Companies, for streets outside of their respective contract territories, when the streets in question are within the territory specified in the Company's charter, when the abutters are favorable, and when the interests of the public, as represented by the street department are protected in a manner satisfactory to the Superintendent. Thus, before the permits recently issued to the Brookline Gas Light Company for street openings in Ward 12 were granted, the Company was required to furnish evidence that the abutters desired such action, and to do an amount of paving or repaving far in excess of that needed to put the street in as good condition as before opening. Within a few days the Company presented requests for Brookline gas service from the Boston and Albany Railroad Company, the New York, New Haven and Hartford Railway Company, the United States Hotel, E. H. Eldridge & Co. (signing for 22 estates), Walter L. Sears, M. H. Shea, the Plymouth Rock Pants Company, the C. E. Osgood Company, the Hub Furniture Company, and over 300 other persons and firms residing or doing business within the district. The Company agreed to the requirements of the Superintendent of Streets, such as repaving with pitch and pebble joints, or concrete base, or from curb to rail, and the residents and property owners of this section of the city have thus secured not only a competitive gas service, but better pavements than before. The Superintendent of Streets informs me that the only person to object was one of the officers of the rival Gas Company. Permit me in closing to refer to several prior communications upon the subject of competition and the law of street openings, particularly to the messages of February 27th, 1893; March 1st, 1893; October 3d, 1893; November 9th, 1893; February 16th, 1894; and June 19th, 1894."

THE betterments on the plant of the Fishkill and Matteawan (N. Y.) Gas Company, carried out by Mr. A. M. Sutherland, have been completed. On September 1st the gas rate was reduced to $1.60, from $2.25 per 1,000.

THE United Gas Improvement Company has been awarded the contract for six sets of its standard double superheater setting of Lowe water gas apparatus, to be erected at the Calf Pasture Station of the Bay State Gas Company, Boston, Mass. The estimated daily producing capacity of the sets is put at 4,000,000 cubic feet, and if memory can be depended upon this is the largest contract on account of water gas apparatus that has been awarded this year. Work has already been started on the plant, which will be completed in time for service during the heavy output of the winter season.

THE Coney Island (N. Y.) Company is in trouble with its consumers, many of whom refuse to settle on the basis of $2 per 1,000, claiming that since the consolidation of Gravesend with the city of Brooklyn the gas rate at Coney Island should not exceed the Brooklyn rate—$1.25 per 1,000.

THE AMERICAN GAS LIGHT JOURNAL

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MONDAY, SEPTEMBER 3, 1894.

The Market for Gas Securities.

Consolidated sold off a trifle during the week, but recovered towards the close, the opening quotation to-day (Friday) being 123½ bid, offered at 124, ex-dividend of 2 per cent. The best informed investors incline to the view that Consolidated is about as high as it is likely to go for the present; not that this opinion is based on the belief that the Company is not in excellent position or that its business is not steadily increasing. The pessimistic view hinges on the pretty well defined belief that dollar gas in New York is not farther off than next spring. The city Companies are all doing an excellent business, and the Standard's increase for the month of July, 1894, as against July, 1893, is really surprising. Equitable and Mutual are quoted at the figures of a week ago. The Brooklyn situation was marked by stout rumors during the week of an agreement between the Fulton-Municipal and Addicks factions, under which they will work in harmony hereafter, but we have no authentic information in that regard. If this is so the Companies outside the breastworks of peace are the Williamsburgh and Nassau, and they could make quite a strong stand. The quotations for Brooklyn shares show great disparity between the value set upon them by holders and inquirers, and we think they are nearer to a sale than a purchase. Chicago gas is weak, along with the general market, and Bay State is going along to the 20 notch. Baltimore Consolidated is offered at 67¼, and Wilmington (Del.) gas is bid for at 188.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks.

16 WALL ST., NEW YORK CITY.

SEPTEMBER 3.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	123½	124
Central	500,000	50	103	—
" Scrip	220,000	—	100	—
Equitable	4,000,000	100	165	—
" Bonds	1,000,000	—	106	108
Metropolitan, Bonds	658,000	—	108	112
Mutual	3,500,000	100	145	—
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	80	95
" Bonds	150,000	—	—	100
Richmond Co., S. I.	348,650	50	50	—
" Bonds	100,000	—	—	—
Standard Gas Co—				
Common Stock	5,000,000	100	25	30
Preferred	5,000,000	100	80	—
Yonkers		50	112	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	101	103
Citizens	1,200,000	20	—	—
" S. F. Bonds	320,000	1000	—	101
Equity Gas Light Co.	2,000,000	100	—	—
Bonds	1,000,000	—	—	—
Fulton Municipal	3,000,000	100	128	—
" Bonds	300,000		103	—
Peoples	1,000,000	10	65	70
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	98	100
Metropolitan	870,000	100	137	—
" Bonds (5's)	70,000	—	—	155
Nassau	1,000,000	25	150	—
" Ctfs	700,000	1000	99	100
Williamsburgh	1,000,000	50	138	—
" Bonds	1,000,000	—	107	110
Out of Town Gas Companies.				
Bay State Gas Co.—				
Stock	5,000,000	50	19½	20
Income Bonds	2,000,000	1000	60	—
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	78	—
2d " " "	3,000,000	1000	57	58
Buffalo Mutual, N. Y.	750,000	100	120	—
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	160	—
Chicago Gas Company.	25,000,000	100	75	75½
Chicago Gas Light. & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	81⅛	81½
Consumers Gas Light Co., Jersey City	2,000,000	100	54	57
Bonds	600,000	1000	92	—
Cincinnati G. & C. Co.	7,000,000	100	192	—
Consumers Toronto	1,600,000	50	184½	187
Central, S. F., Cal.			90	100
Capital, Sacramento, Cal			—	55
Consolidated, Balt.	11,000,000	100	—	67¼
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	101
Bonds	250,000		—	—
Detroit Gas Co.—				
Con. Bonds	.....	.....	—	50
East River Gas Co., Long Island City	1,000,000	100	16	19
Preferred	.....	.....	25	35
Bonds	500,000	100	80	82
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	101
Hartford, Conn	750,000	25	120	128
Jersey City	750,000	20	190	200
Louisville, Ky	2,570,000	50	125	130
Laclede Gas Light Co. St. Louis, Mo.—				
Common Stock	7,500,000	100	19¼	19½
Preferred "	2,500,000	100	72	74
Bonds	9,034,400	1000	88	89
Little Falls N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Montreal, Canada	2,000,000	100	200	208
New Haven, Conn		25	200	—
Oakland, Cal			42⅜	43
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	108
2d "	2,500,000	1000	104	105
Peoples, Jersey City	500,000	—	175	185
" " Bonds			—	—
Paterson, N. J		25	99	102
Rochester, N. Y.		50	80	85
Preferred			90	95
Bonds			90	95
Syracuse, N. Y.	500,000	25	—	—
San Francisco Gas Co. San Francisco, Cal.	10,000,000	100	71	71½
Washington, D. C.	2,000,000	20	240	—
Wilmington, Del.	500,000	50	188	190

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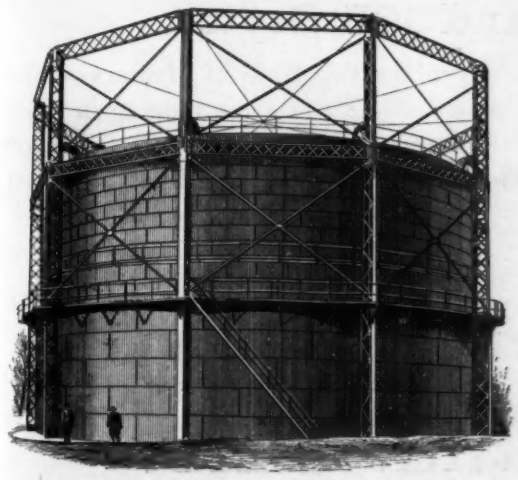

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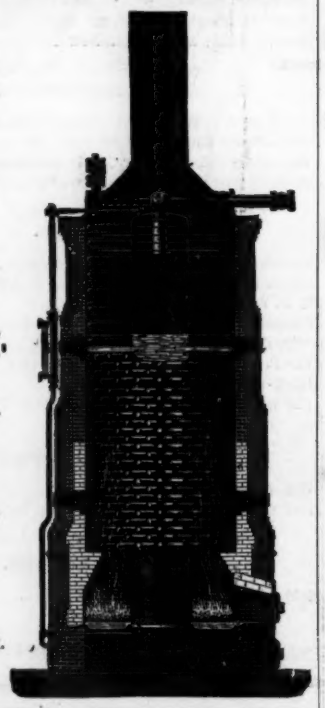

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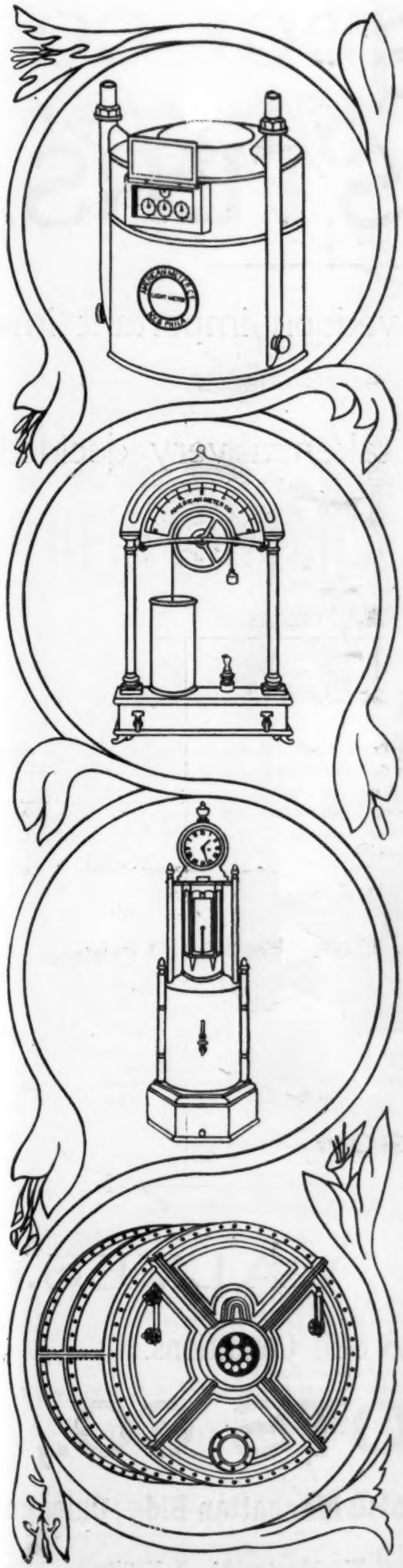

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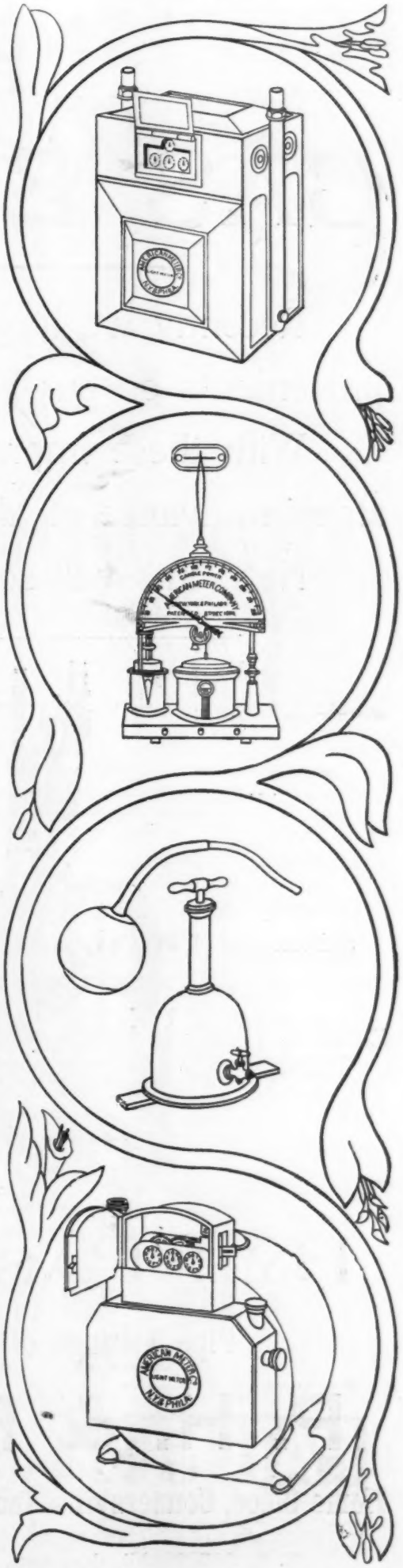
PUBLIC LIGHTING TABLE.

SEPTEMBER, 1894.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Sat.	1	7.00 PM	4.30 AM	6.30	4.20
Sun.	2	7.00	4.30	6.30	4.20
Mon.	3	7.00	4.30	6.15	4.30
Tue.	4	7.50	4.30	6.15	4.30
Wed.	5	8.30	4.30	6.15	4.30
Thu.	6	9.10 FQ	4.30	6.15	4.30
Fri.	7	9.50	4.30	6.15	4.30
Sat.	8	10.50	4.30	6.15	4.30
Sun.	9	11.50	4.30	6.15	4.30
Mon.	10	12.50 AM	4.40	6.05	4.40
Tue.	11	1.50	4.40	6.05	4.40
Wed.	12	2.50	4.40	6.05	4.40
Thu.	13	No L.	No L.	6.05	4.40
Fri.	14	No L. FM	No L.	6.05	4.40
Sat.	15	No L.	No L.	6.05	4.40
Sun.	16	6.40 PM	7.50 PM	6.05	4.40
Mon.	17	6.40	8.10	5.55	4.50
Tue.	18	6.30	8.30	5.55	4.50
Wed.	19	6.30	9.10	5.55	4.50
Thu.	20	6.30	9.50	5.55	4.50
Fri.	21	6.30	10.40	5.55	4.50
Sat.	22	6.30 LQ	11.40	5.55	4.50
Sun.	23	6.30	12.50 AM	5.55	4.50
Mon.	24	6.20	2.10	5.40	5.00
Tue.	25	6.20	3.30	5.40	5.00
Wed.	26	6.20	4.50	5.40	5.00
Thu.	27	6.20	4.50	5.40	5.00
Fri.	28	6.20	4.50	5.40	5.00
Sat.	29	6.20 NM	4.50	5.40	5.00
Sun.	30	6.10	5.00	5.40	5.00

TOTAL HOURS LIGHTING DURING 1894.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	244.10	January	423.20
February	195.30	February	355.25
March	206.20	March	355.35
April	169.40	April	298.50
May	162.10	May	264.50
June	135.40	June	234.25
July	146.30	July	243.45
August	162.20	August	280.25
September	174.10	September	321.15
October	211.20	October	374.30
November	221.00	November	401.40
December	245.30	December	433.45
Total	2274.20	Total	3987.4[illegible]



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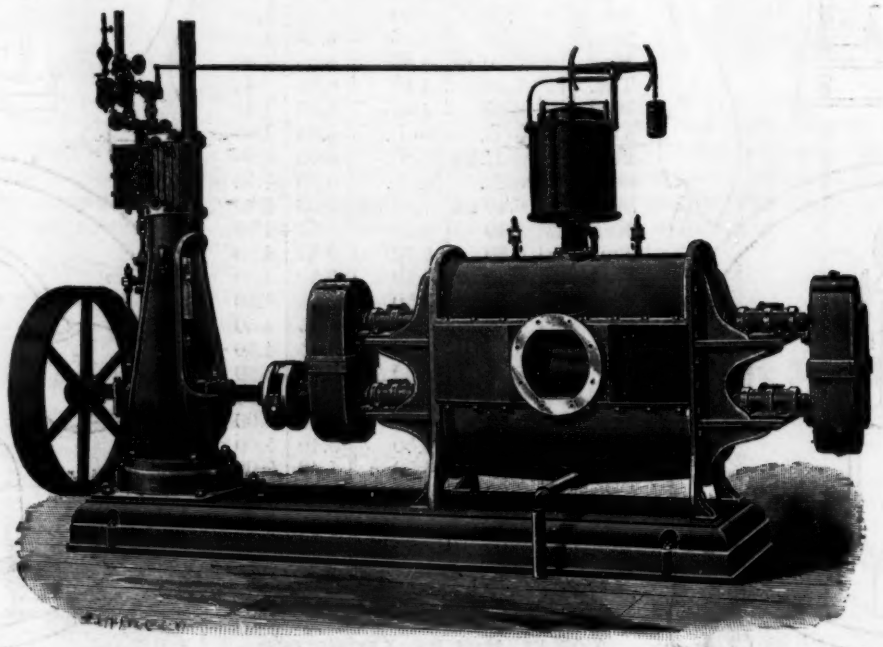

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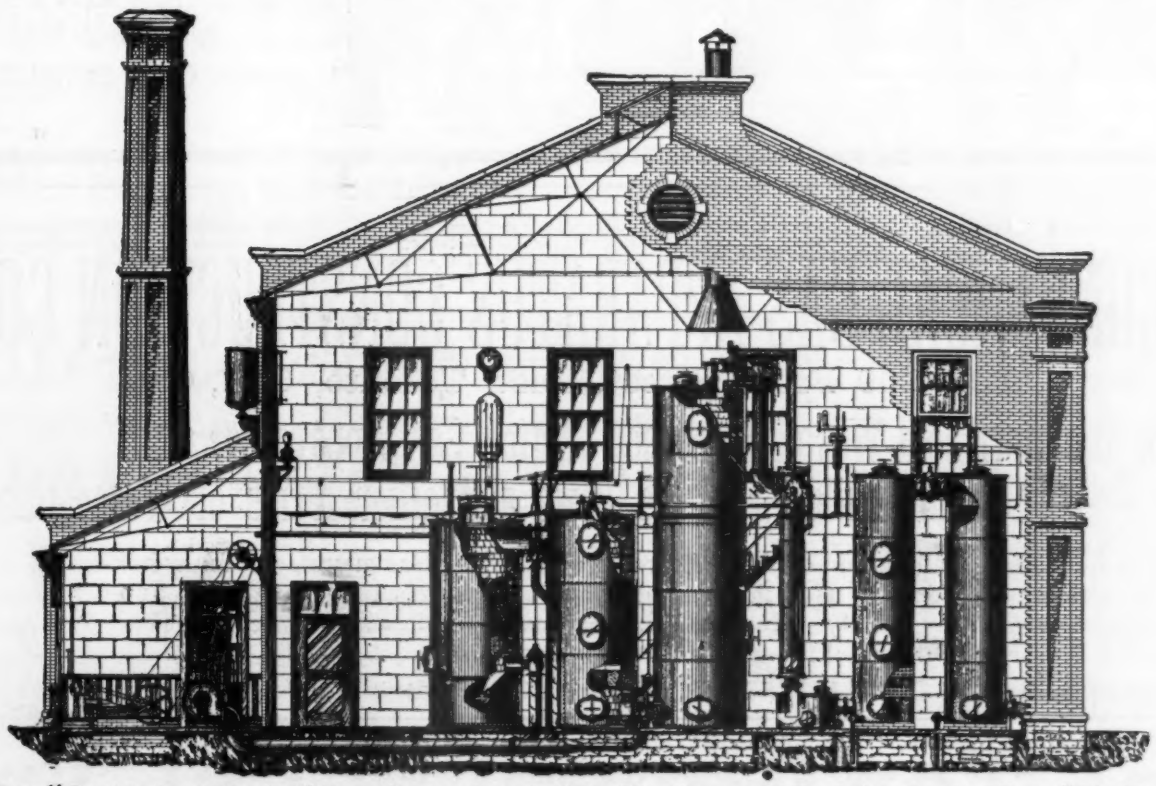

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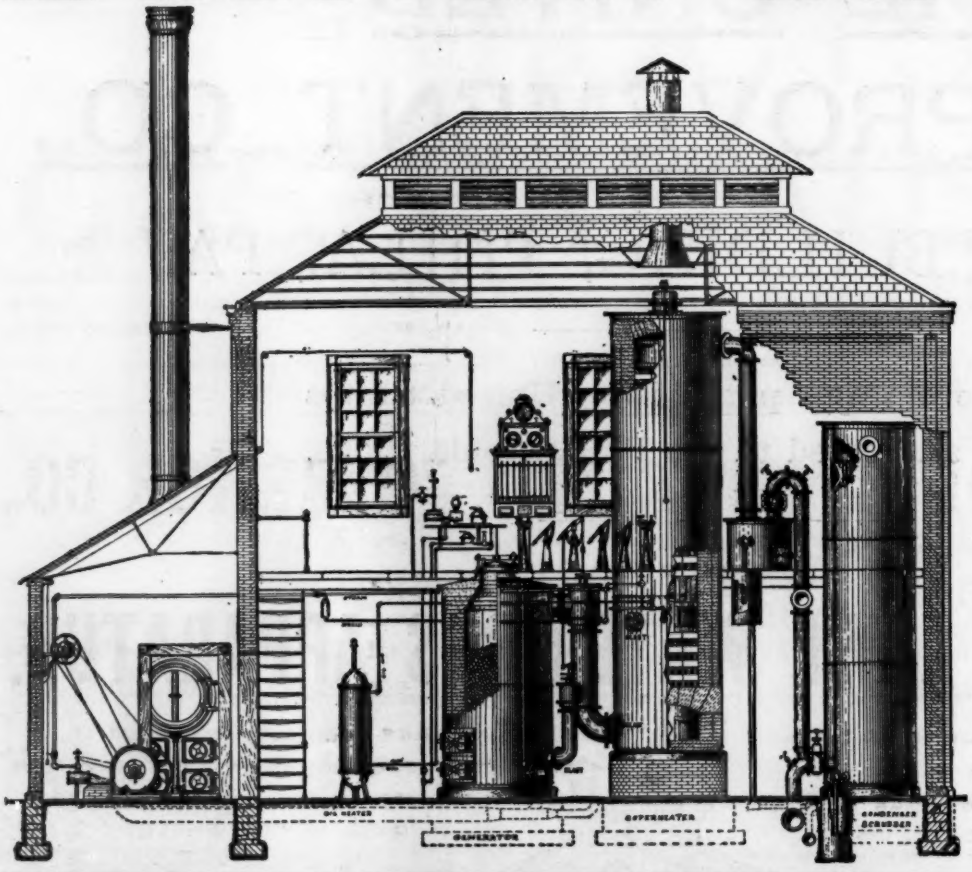

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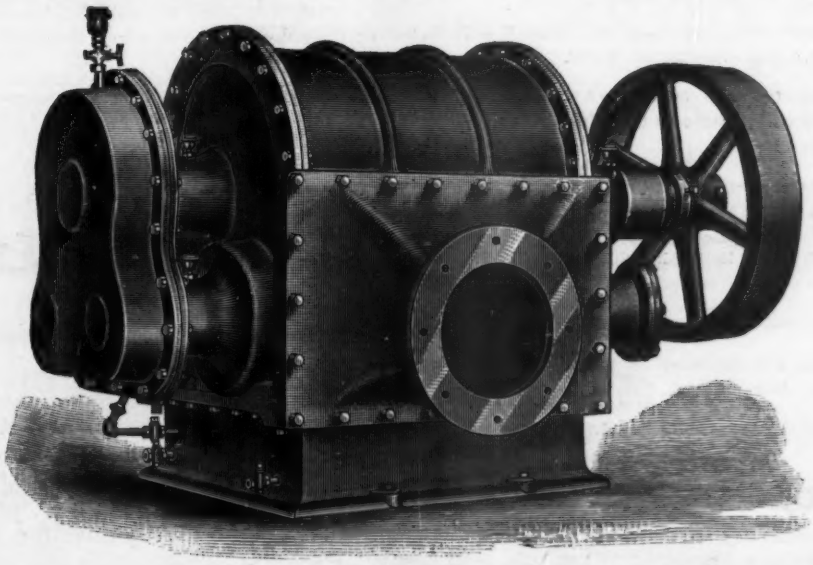

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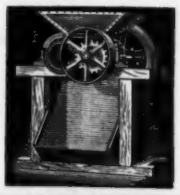

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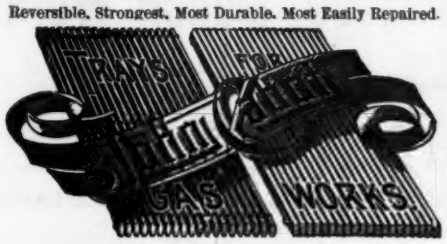

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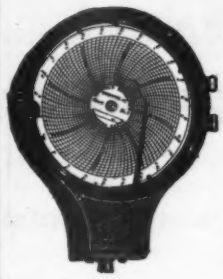

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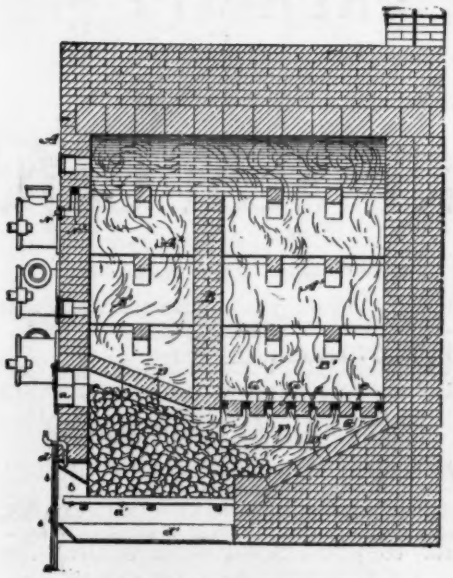

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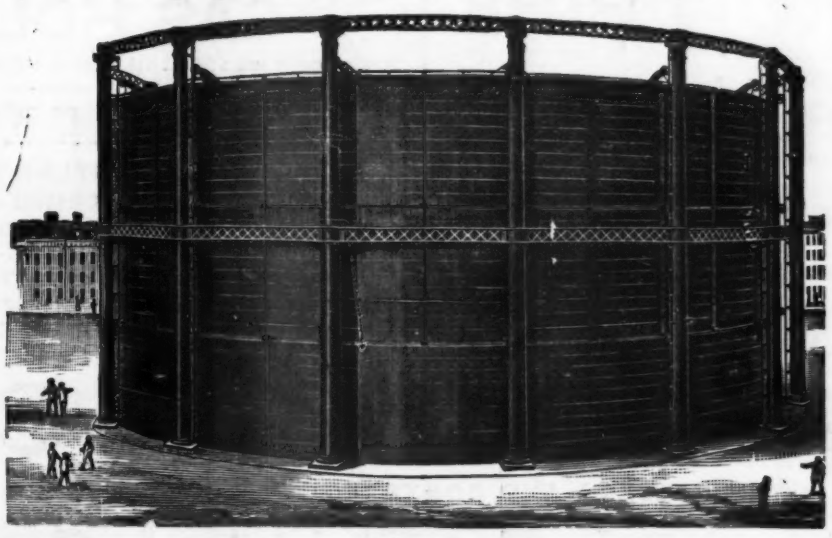

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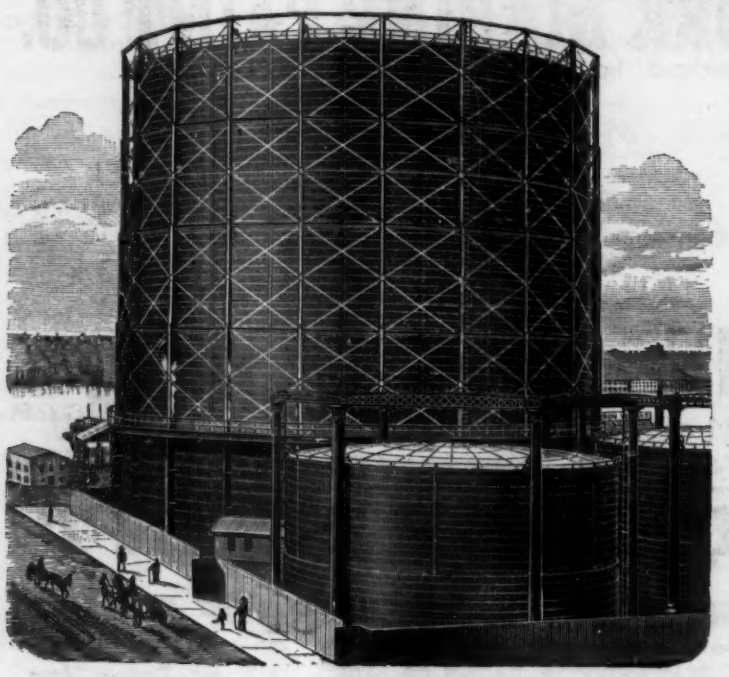

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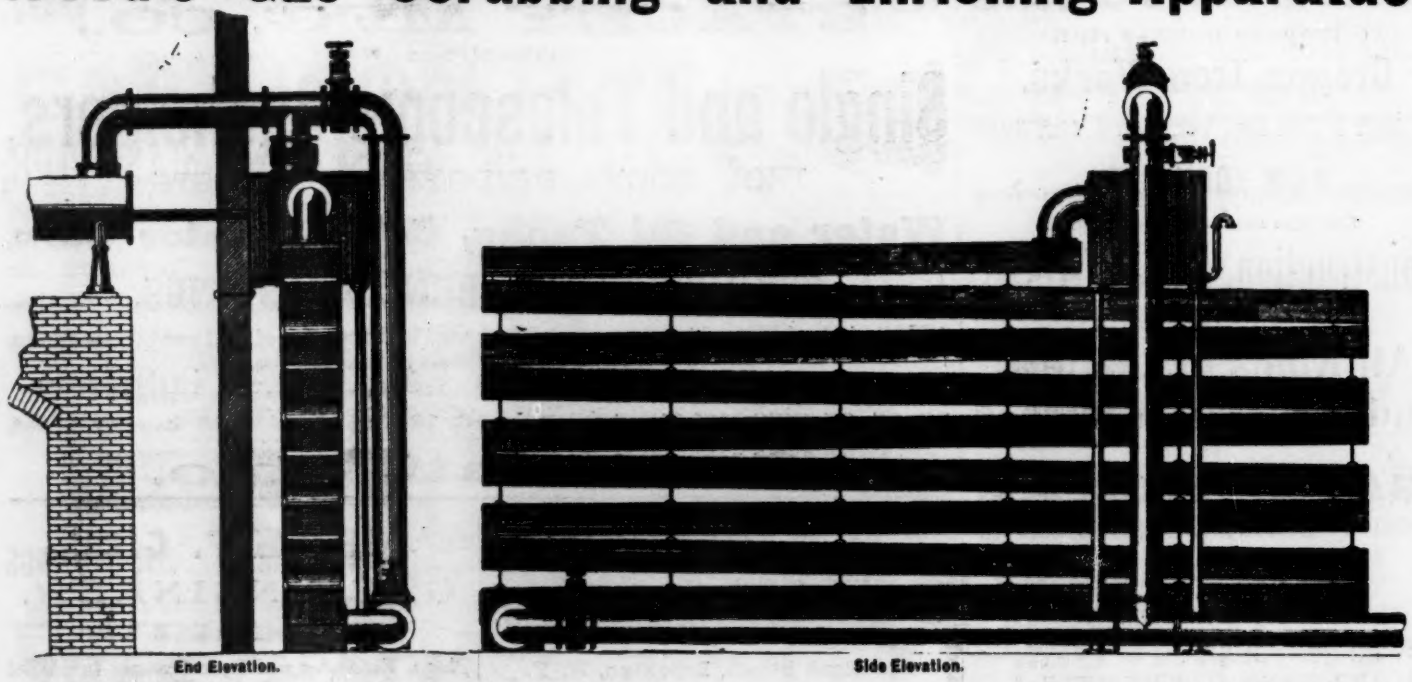

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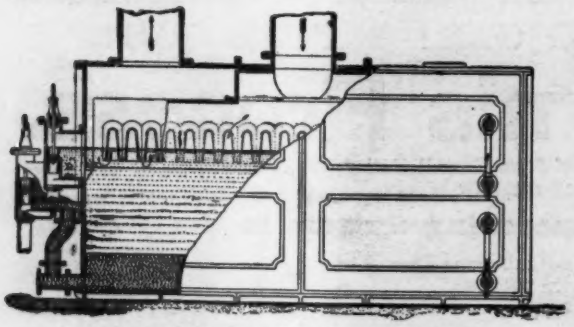

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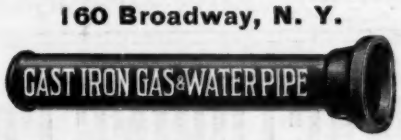

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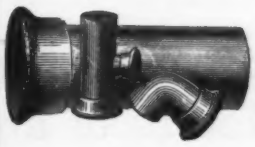

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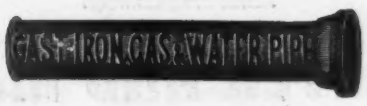

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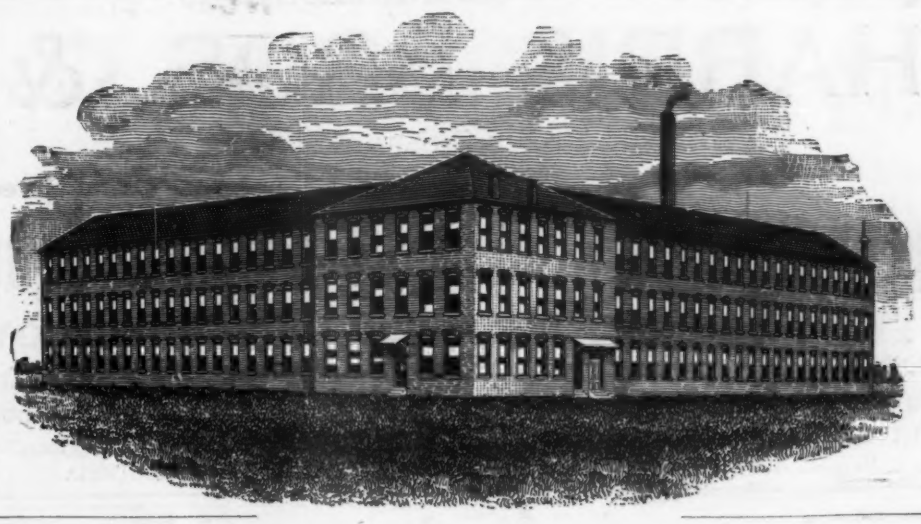

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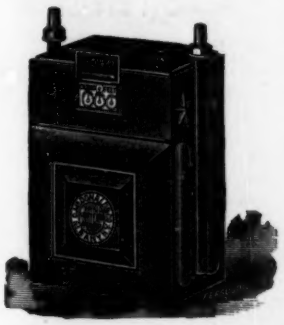

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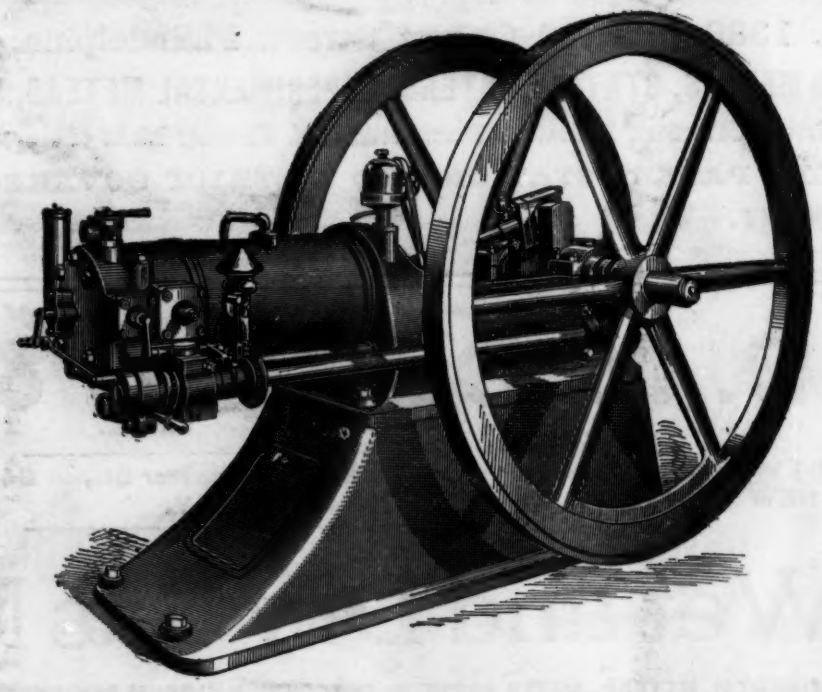

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